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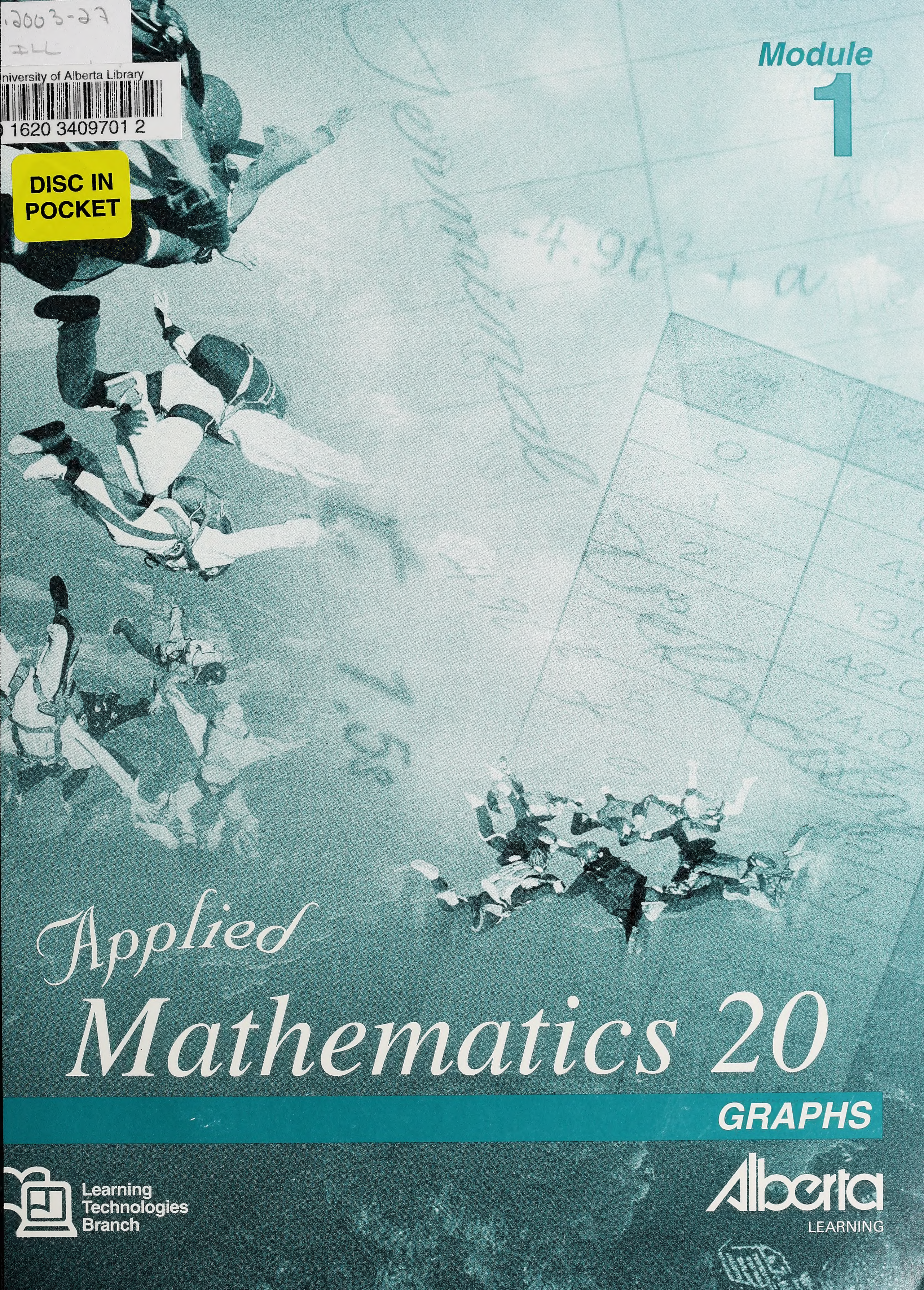

## Module
## 1

# Applied Mathematics 20

## GRAPHS

Learning Technologies Branch

Alberta LEARNING

Applied Mathematics 20
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Module

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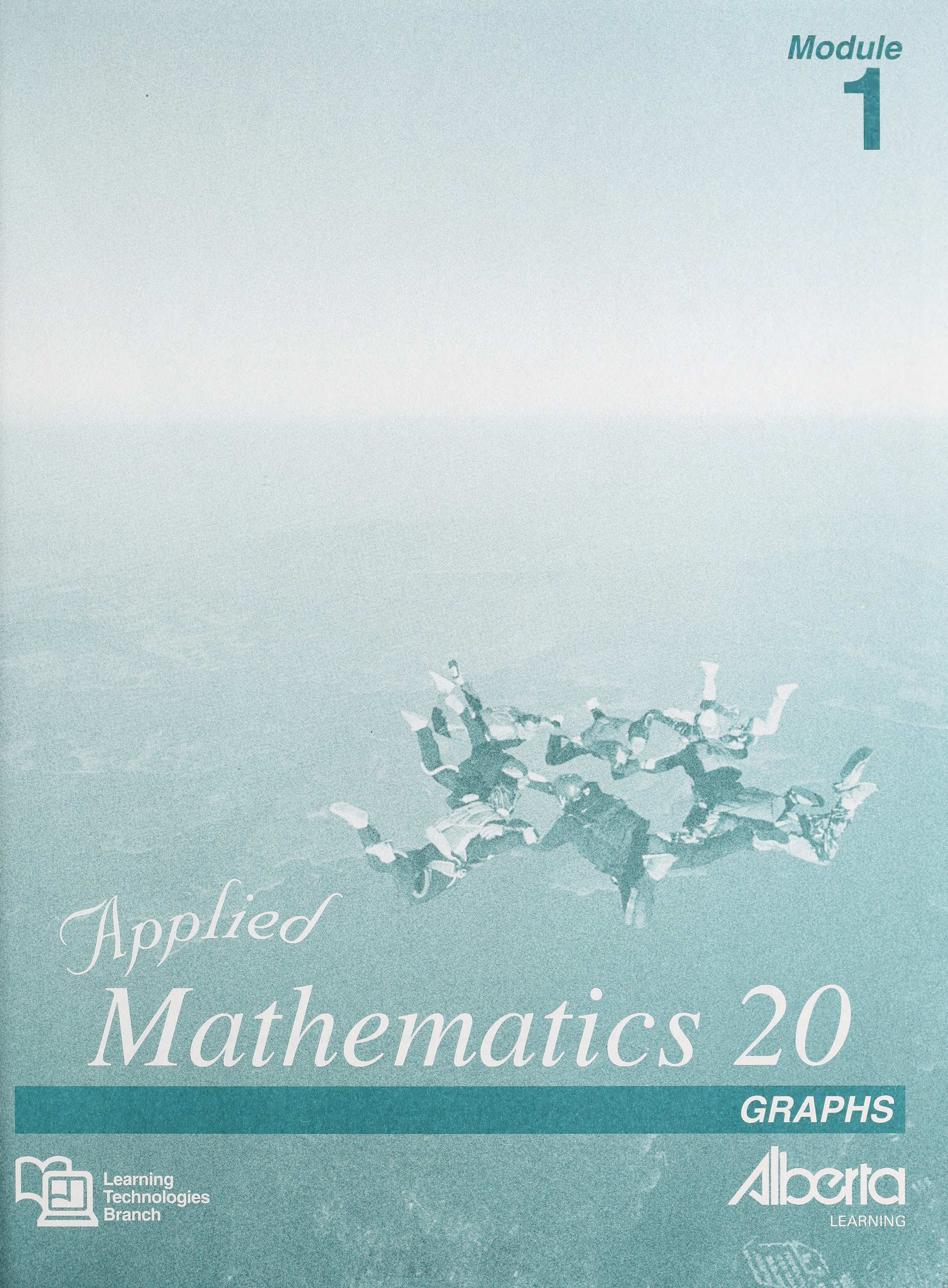

# Applied Mathematics 20

## GRAPHS

Learning
Technologies
Branch

Alberta
LEARNING

Applied Mathematics 20
Module 1: Graphs
Student Module Booklet
Learning Technologies Branch
ISBN 0-7741-1890-3

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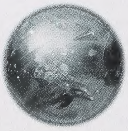

The Learning Technologies Branch has an Internet site that you may find useful. The address is as follows:

**http://www.learning.gov.ab.ca/ltb**

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# Welcome

## Applied Mathematics 20

Module 1
Graphs

Module 2
Non-Linear Functions

Module 3
Linear Systems

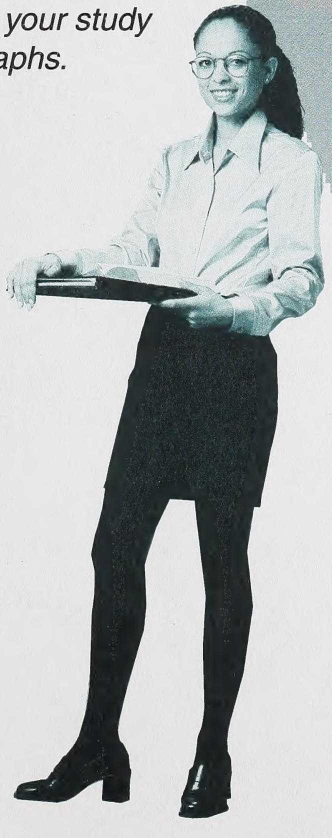
Module 4
Linear Programming

Module 5
Finance

Module 6
Circles

Module 7
Measurement

*Welcome to Module 1. We hope you'll enjoy your study of Graphs.*



Applied Mathematics 20 contains seven modules and a final test. Work through the modules in the order given, since several concepts build on each other as you progress through the course.

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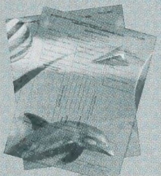

*Submit the Module Project.*

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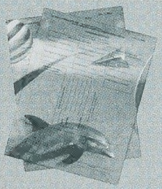

*Submit the Module Assignment.*

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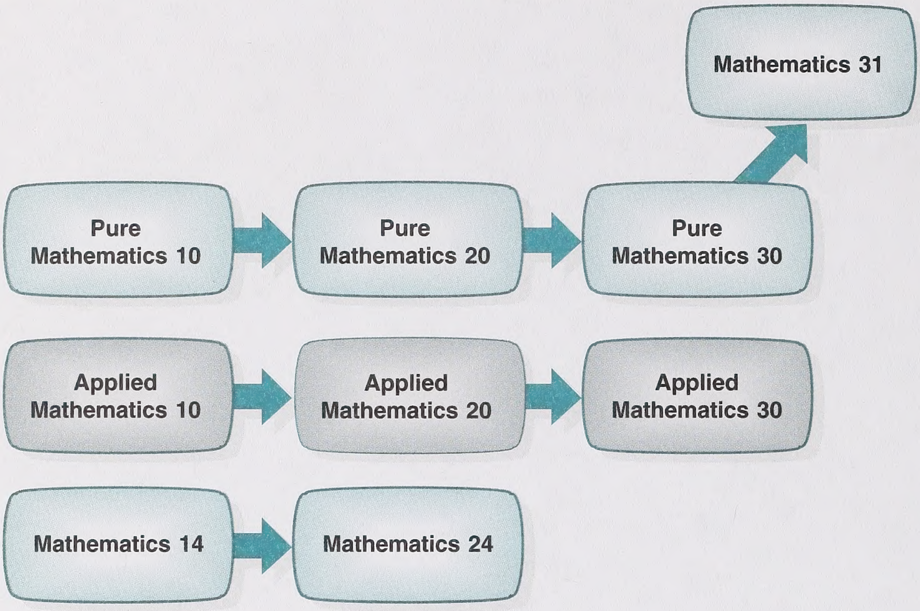
# Introduction to Applied Mathematics 20

Applied Mathematics 20 is the second course in the Applied Mathematics 10–20–30 program of studies. Another program of studies is Pure Mathematics 10–20–30; students who complete Pure Mathematics 30 often choose to take Mathematics 31. A third program of studies is Mathematics 14–24.



Each mathematics program is designed for students with different mathematical strengths and interests.

- Pure Mathematics 10–20–30 is intended for students who are strong in algebra and mathematical theory.
- Applied Mathematics 10–20–30 is better suited to students who prefer to solve problems using numerical reasoning or geometry.
- Mathematics 14–24 is a general mathematics program for high school students who have experienced difficulties in previous mathematics courses.

Each sequence of courses is designed for students with different career plans. For example, Pure Mathematics 30 is a prerequisite for admission to many university programs. Many colleges and technical institutes, however, will admit students who have successfully completed Applied Mathematics 30.

You may find it helpful to read "Questions and Answers About Senior High School Mathematics" and "The New Senior High School Mathematics Program and Post-Secondary Studies." These documents can be found at the following Internet site:

**http://www.learning.gov.ab.ca/k_12/curriculum/bySubject/math**

Before enrolling in Applied Mathematics 20, it is recommended that you talk with a school counsellor about your career plans.

## TRANSFERRING FROM THE APPLIED PROGRAM

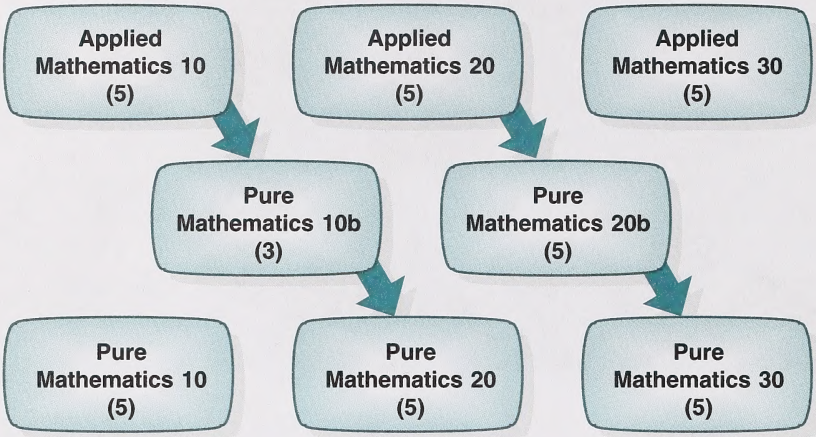
You should be aware that the applied and pure mathematics courses do have some topics in common; other topics are independent.

The following table shows some common and independent topics.

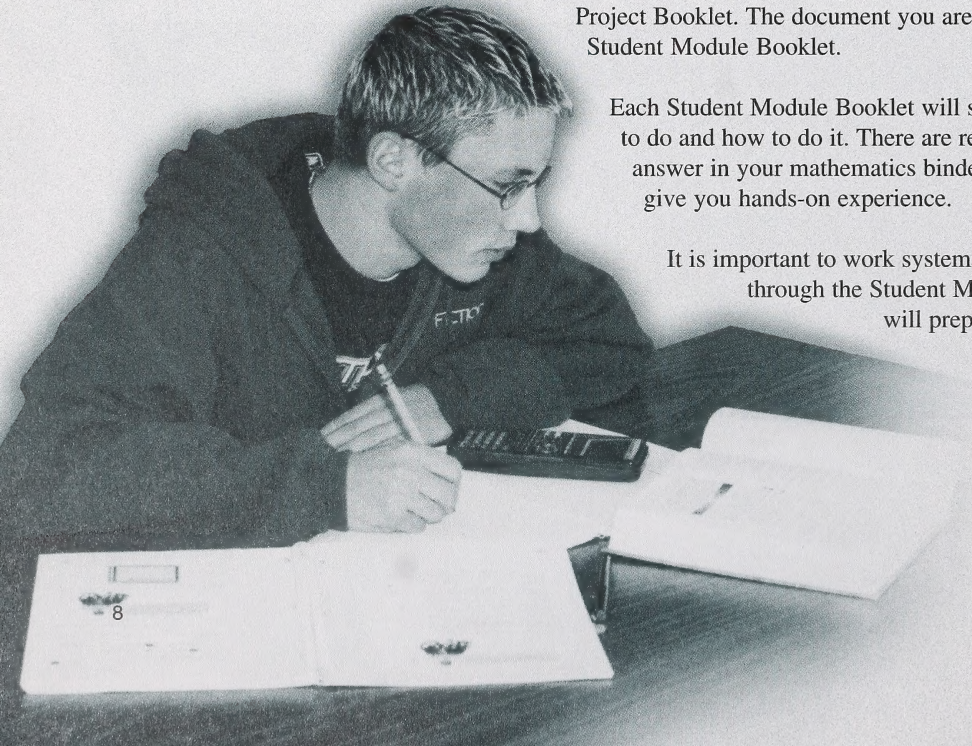
| Applied Topics | Common Topics | Pure Topics |
|---|---|---|
| • linear programming<br>• data tables and trends<br>• design and layout<br>• metric and imperial measure<br>• data presentation<br>• vectors and matrices<br>• periodic, fractal, and recursive patterns<br>• financial decision making<br>• costing and design problems | • spreadsheets<br>• line segments and linear graphs<br>• scaling<br>• triangles<br>• surveys<br>• financial mathematics<br>• quadratic functions<br>• circle geometry<br>• the bell curve | • irrational numbers<br>• exponents<br>• polynomial and rational expressions<br>• mathematical expectation<br>• growth patterns<br>• linear and non-linear systems<br>• operations on functions<br>• mathematical reasoning<br>• exponential and logarithmic functions<br>• conics<br>• combinations<br>• trigonometric functions |

If you want to transfer from the Applied Mathematics 10–20–30 sequence to the Pure Mathematics 10–20–30 sequence at a future time, you won't have to repeat the topics that are common to pure mathematics and applied mathematics.

If you decide to transfer to Pure Mathematics 20 after successfully completing Applied Mathematics 10, you may have to take a three-credit course called Pure Mathematics 10b. If you decide to transfer to Pure Mathematics 30 after successfully completing Applied Mathematics 20, you may have to take a five-credit course called Pure Mathematics 20b. The two bridging courses are shown in the following diagram.



## STRATEGIES FOR COMPLETING APPLIED MATHEMATICS 20



For each module in Applied Mathematics 20, there is a Student Module Booklet, an accompanying Assignment Booklet, and a Project Booklet. The document you are presently reading is called a Student Module Booklet.

Each Student Module Booklet will show you, step-by-step, what to do and how to do it. There are readings, questions for you to answer in your mathematics binder, and applications that will give you hands-on experience.

It is important to work systematically and carefully through the Student Module Booklets. This work will prepare you for the assignments, projects, and final test.

Following are some suggestions for organizing your mathematics binder:

- Keep a section of your binder to record your responses to the questions in the Student Module Booklet. Also store your marked assignments here.

- Keep a section of your binder for work in progress on your projects. Keep your research notes, plans, rough drafts, and so on.

- Keep a section of your binder to record new skills and concepts, as well as important results and formulas. Get in the habit of describing new skills and concepts in your own words.

  Record useful ways to help you remember what a concept means. Make charts and diagrams to help you connect mathematical ideas.

- Keep a section of your binder to record mathematical accomplishments. This can include solutions to problems that you are proud of solving. It can also include landmark events, such as when you grasped a difficult concept (an "aha!" experience), or when you used a calculator or spreadsheet in a new way.

## Mathematical Processes

Throughout this course, you will be expected to perform the following mathematical processes:

- Connect mathematical ideas to everyday experiences and to concepts in other disciplines.
- Develop and use problem-solving strategies.
- Reason and justify your answers.
- Communicate mathematical ideas.
- Select and use appropriate technologies to solve problems.
- Develop and use estimation and mental-math strategies.
- Use visualization to assist in processing information, making connections, and solving problems.

In order to develop these mathematical processes more fully, you are encouraged to ask someone who is also taking Applied Mathematics 20 to be your study partner. You will find that having a friend to discuss mathematical ideas with will make your studying more enjoyable.

# Resources You Will Need

In addition to the distance learning materials for Applied Mathematics 20, you will need the following resources:

- the *Addison-Wesley Applied Mathematics 11 Source Book* Western Canadian Edition, published by Addison Wesley Longman Ltd. (2000)
- a binder, lined loose-leaf paper, graph paper, dividers, pencils, eraser
- metric and imperial measuring devices, such as a ruler, yardstick, metre-stick, and tape measure
- a mathematical instrument set (compass, protractor, and triangles)
- a computer with a spreadsheet program

  **Note:** Two popular spreadsheet programs are *ClarisWorks*™ and Microsoft® *Excel.*
- a graphing calculator

  **Note:** Where it is applicable, the examples in this course and the textbook show the TI-83 calculator; however, all of the graphing calculators in the following chart are approved for use on tests.

| Texas Instruments | Sharp | Casio | Hewlett-Packard |
|---|---|---|---|
| TI-82** | EL-9600C | Algebra FX 2.0 | HP 39g |
| TI-83 | EL-9600* | CFX-9850 GA-Plus* | |
| TI-83 Plus | EL-9200* | CFX-9850 G* | |
| TI-86 | EL-9300* | CFX-9800 G* | |
| TI-89 | | FX-9700 series* | |
| TI-92* | | | |
| TI-92 Plus | | | |

*no longer commercially available

**The TI-82 calculator will remain on the approved list for the 2000–2001 and 2001–2002 school years and will then be deleted from the approved list.

If you intend to use the TI-83 or TI-83 Plus graphing calculator, it is recommended that you obtain the video program *The TI-83 Graphing Calculator Video Tutor.*

Many of the resources that you will need may be purchased locally or from the Learning Resources Centre (LRC). Following is the LRC website:

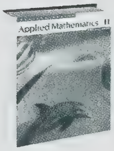
**http://www.lrc.learning.gov.ab.ca**

You may wish to discuss the availability of resources with your teacher, as your school division may have a loan policy.

## Visual Cues

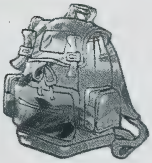
You will find many visual cues in this course. Colour is used to highlight terms that are defined in the Glossary of the Appendix of each Student Module Booklet. You will also find several icons in the margins. Read the following explanations to discover what the various icons prompt you to do.

- Refer to the textbook.

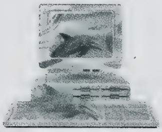


- Refer to the Applied Mathematics 20 CD.

- Use mathematical instruments or measuring tools.

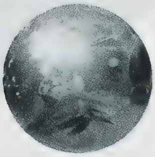


- Work with a computer.



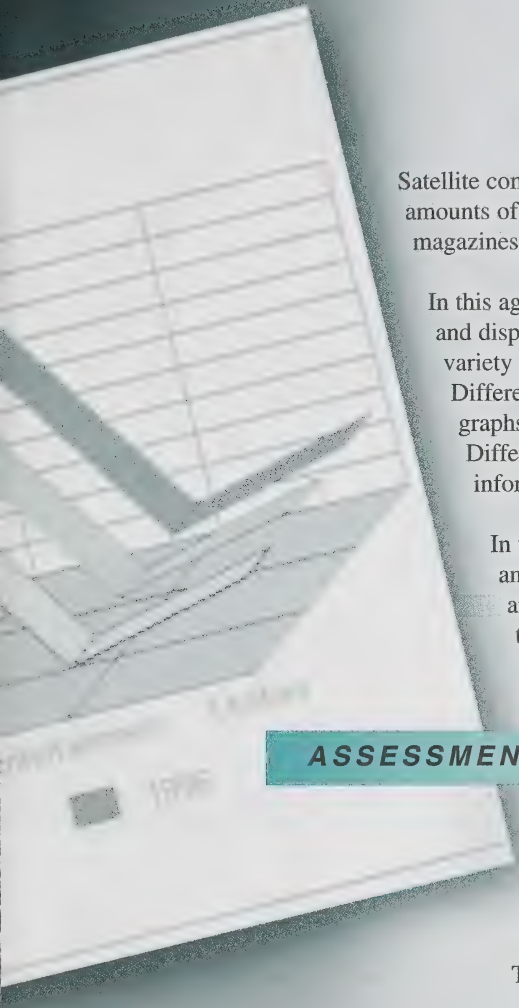
- Complete the module project or assignment.

- Explore the Internet.



**Remember:** Any Internet website address given in this module is subject to change.

# MODULE OVERVIEW



Satellite communication has opened the door to instantaneous transfer of large amounts of information. This information is available through newspapers, magazines, the Internet, television, and radio.

In this age of massive amounts of information, various ways of organizing and displaying information is required. Graphs and tables come in a wide variety of shapes and types and are a major way of organizing information. Different types of graphs include population pyramids, stacked bar graphs, multiple-line graphs, multiple-bar graphs, and picture graphs. Different types of graphs are used to portray different kinds of information.

In this module you will analyse and interpret various types of graphs and tables of data. You will then create and adapt graphs to compare and contrast sets of data. You will also collect and display various types of data.

## ASSESSMENT

Accompanying this Student Module Booklet is a Project Booklet and an Assignment Booklet. Your grading in this module will be based upon the module project and the module assignment you submit for evaluation.

The mark distribution is as follows:

| | |
|---|---|
| **Module Project** | **40 marks** |
| **Module Assignment** | **60 marks** |
| **TOTAL** | **100 marks** |

Remember that Activities 1 to 5 in this Student Module Booklet will prepare you for completing the module project and the module assignment. You should work through these activities carefully and compare your answers with the suggested answers provided in the Appendix.

The Follow-up Activities provide extra help and enrichment. You may choose to do some or all the questions in the Follow-up Activities. Again, you should compare your answers with the suggested answers provided in the Appendix.

# MODULE PROJECT
## EXAMINING DATA

## Beginning the Project

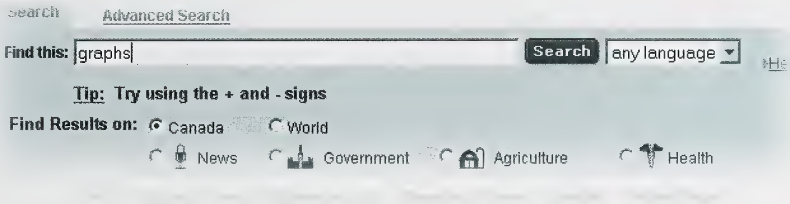
Graphs and tables often appear in financial articles found in newspapers and magazines. Many companies use graphs and tables to present information to other companies, to shareholders, and to the general public, to name a few.

If you search through a typical urban centre newspaper, like the *Edmonton Journal* or the *Calgary Herald*, you will often find a number of graphs and tables in articles related to various topics.

Your project for Module 1: Graphs is to collect a variety of newspaper or magazine articles containing tables of data and graphs. Firstly, you will review every article collected and select one that contains at least one graph. You will describe, analyse, and interpret the data and graphs in the article chosen. Secondly, you will select another article containing a table of data. You will create a graph using the data from the article chosen. Lastly, you will select an article containing a graph that could be misleading. You will describe why you think the graph is misleading and how it could be corrected.

Turn to page 2 of the textbook and read "Examining Data." Complete the questions posed, and store your answers in the project section of your mathematics binder. You may not be able to answer all of the questions at this time; but as you work through this module, you should return to your mathematics binder and answer these questions more fully.

You may wish to begin your research by entering the word *graphs* into one of the Internet's search engines. Areas where graphs are often used are on stock market sites and sites with financial reports.



Find this: graphs

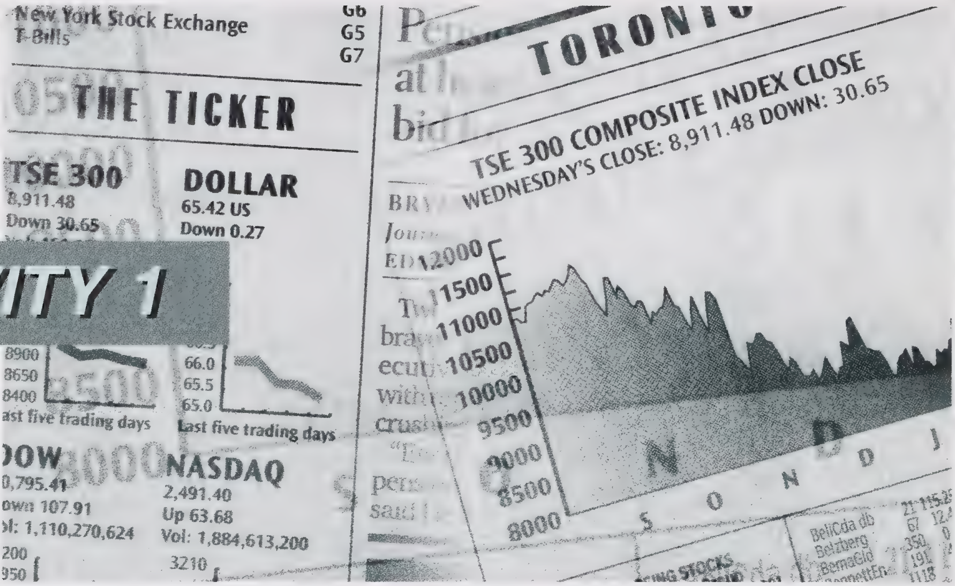
Find Results on: ● Canada ○ World ○ News ○ Government ○ Agriculture ○ Health

As you work through Activities 1 to 5, continue to search for newspaper or magazine articles containing tables of data and graphs. You will need examples of regular graphs as well as examples of misleading graphs for your project. You will analyse both a regular graph and a graph that is ambiguous in your project. You will also create a graph from a table of data that you have located in a newspaper or magazine article.

Working through Activities 1 to 5 will help you gain the skills and concepts you will need to complete the module project and the module assignment. You will complete the Examining Data project in the Project Booklet after the Follow-up Activities.

You will be given more direction later in this module. In the meantime, feel free to discuss this project with a study partner or a family member. Remember, the work on the project you submit must by your own.

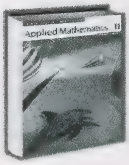
# ACTIVITY 1



# Interpreting Graphs and Tables of Data

Do you read newspaper or magazine articles from time to time? Do you come across tables and graphs in these articles? Are you able to analyse and interpret the tables and graphs?

In previous mathematics courses, you studied different ways of presenting data graphically. You created circle graphs, histograms, bar graphs, and line graphs. In this activity you will analyse and interpret various types of tables of data and graphs.



Review the definitions for the various graphs mentioned previously in the Student Reference section of the textbook, pages 423 to 445; then answer the following exercises.

**1.** Answer exercises 1 to 4 of “Practise Your Prior Skills” on pages 4 and 5 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 1, pages 42–44.**

Some other types of graphs that you may not be familiar with include population pyramids, stacked bar graphs, and multiple-line graphs. The ability to read and interpret these types of graphs is especially valuable in an age where people are constantly bombarded with numerical information in newspapers and magazines and on television and the Internet.

Turn to pages 6 and 7 of the textbook and work through "Example 1: Interpreting Tabular Data."

**2.** Answer exercise 2 of "Exercises: Checking Your Skills" on page 15 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 1, page 45.**

**Population pyramids** are graphical representations of the number of people of various ages of a given population. A population pyramid usually consists of two graphs placed back-to-back on one vertical axis. Often, a population pyramid is used to compare male and female numbers in each age group.

Turn to pages 7 and 8 of the textbook and read the last two paragraphs on page 7 and study the two population pyramids on page 8.

**3.** **a.** Why is a population pyramid narrower at the top?

**b.** How do you know that the population pyramid at the top of page 8 of the textbook has a high child mortality rate (number of deaths per 1000)?

**c.** Give an example of a country that would have a population pyramid similar to the one at the bottom of page 8 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 1, page 45.**

For more information on population pyramids view the segment titled *Analysis of Graphs: Population Pyramids* on the Applied Mathematics 20 CD.

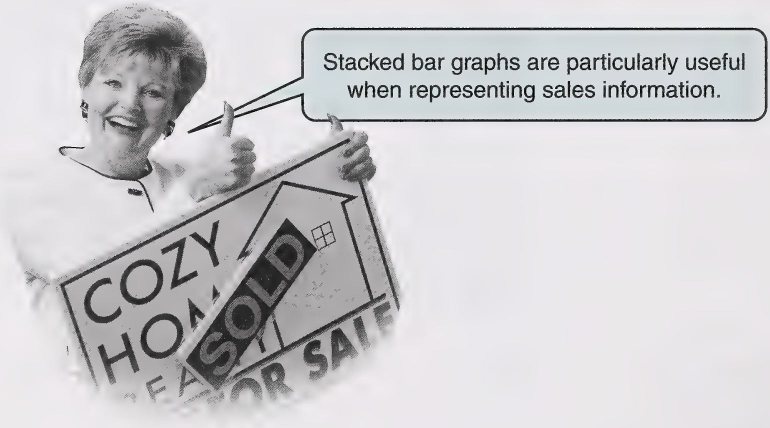
Turn to pages 9 and 10 of the textbook and work through "Example 2: Interpret a Population Pyramid."

**4.** Answer exercises 1 and 3 of "Exercises: Checking Your Skills" on pages 14 to 16 of the textbook. For exercise 3, the red line indicates the population pyramid for 1961 and the shaded area indicates the population pyramid for 1991.

**Compare your responses with the suggested answers in the Appendix, Activity 1, pages 45–46.**

Analysing population pyramids can help predict future trends. One group that has influenced governments and industries is the Baby Boomer generation. For more information on Baby Boomers, view the segment titled *Analysis of Graphs: Baby Boomers* on the Applied Mathematics 20 CD.

Another type of graph is the **stacked bar graph**. A stacked bar graph is used to display data that has totals in two or more categories that you would like to display together to show an overall total.


Stacked bar graphs are particularly useful when representing sales information.
COZY
HO
SOLD
OR SAL

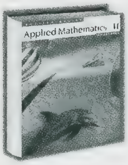
Turn to pages 10 and 11 of the textbook and work through "Example 3: Stacked Bar Graph."

**5.** Answer exercises 4, 5.a., 5.b., and 5.d. of "Exercises: Checking Your Skills" on pages 16 and 17 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 1, page 46.**

You are probably most familiar with line graphs from your previous studies. **Multiple-line graphs** are simply two or more line graphs on the same grid. To be placed on the same grid, each of the line graphs must have the same units on each axis.

Multiple-line graphs are particularly useful in business when comparing fixed costs, variable costs, total cost, and revenue.



Turn to pages 11 to 13 of the textbook and work through "Example 4: Multiple-line graph."

**6.** Define the following terms. Refer to the graph in exercise 6 on page 17 of the textbook.

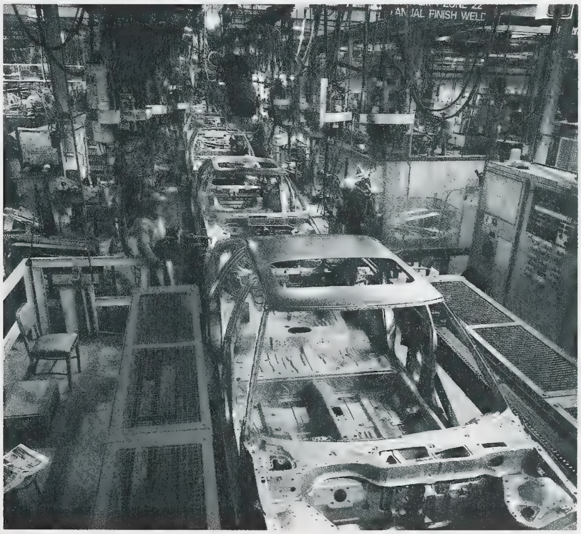
**a.** fixed cost
**b.** variable cost
**c.** total cost
**d.** revenue
**e.** net profit
**f.** gross profit

**7.** Answer exercises 6 and 7 of "Exercises: Checking Your Skills" on pages 17 and 18 of the textbook.

**8.** Answer exercises 1 to 3 of "Discussing the Ideas" on page 13 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 1, pages 47–48.**

Another type of graph you need to be familiar with is the **picture graph**. In a picture graph, usually a picture of the type of data displayed (such as using cars to represent a certain number of automobiles produced) is used to convey information about the data.



## Example

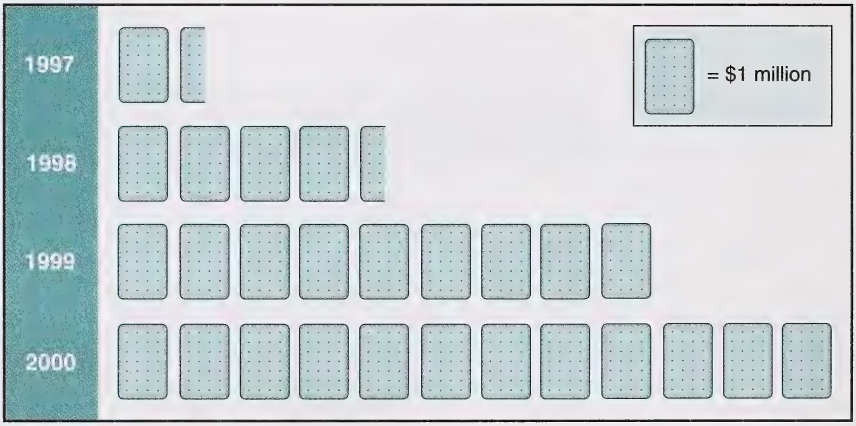
A mattress shop has records showing the following sales over a four-year period (1997–2000). Complete a picture graph illustrating the information in the table.

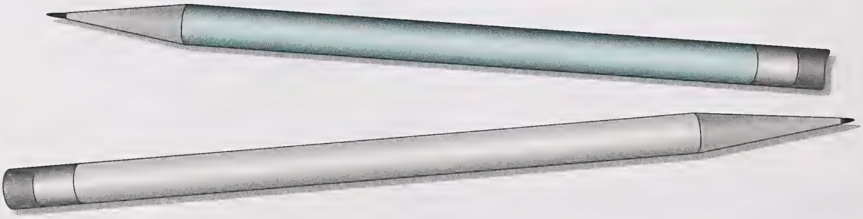
| Year | Sales ($ millions) |
|---|---|
| 1997 | 1.5 |
| 1998 | 4.5 |
| 1999 | 9.0 |
| 2000 | 12.0 |

### Solution

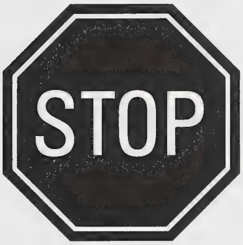
A picture graph illustrating the information could look like the following.

**Mattress Sales**

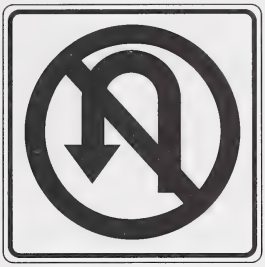




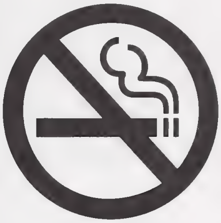
Some picture graphs—such as road signs, camping signs, or ratings signs—are designed to convey special information. Such picture graphs are called **glyphs**. Glyphs are multi-level picture graphs, where a number of ways—such as size, shape, and colour—are used to convey the information. The following are examples of glyphs.



**Sign 1**



**Sign 2**



**Sign 3**

**9.** Describe what each of the previous signs mean.

**10.** Give three ways in which the information in the stop sign is presented.

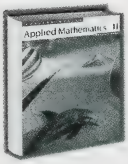
**11.** Give three occupations or work areas where glyphs are used.

**12.** List one advantage and one disadvantage of glyphs.

**Compare your responses with the suggested answers in the Appendix, Activity 1, page 49.**

## LOOKING BACK

In this activity you identified and analysed a number of different types of graphs. You studied some special types of graphs, including population pyramids, stacked bar graphs, multiple-line graphs, and picture graphs.



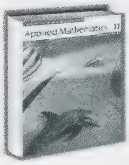
**13.** Turn to page 20 of the textbook and answer "Communicating the Ideas."

**Compare your response with the suggested answer in the Appendix, Activity 1, page 49.**

# ACTIVITY 2

## Time Graphs

The first thing that comes to mind for many students when time graphs are mentioned is the distance-time graph. The distance a person or object has travelled over a period of time is a common example of a time graph.

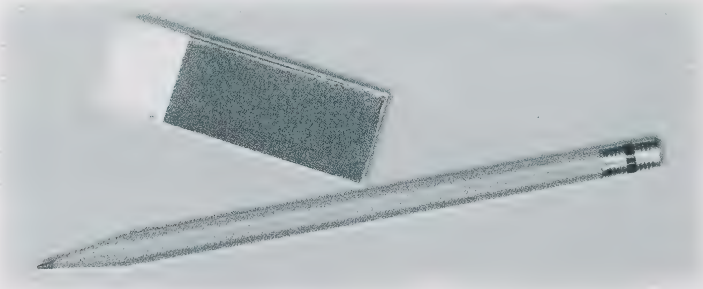


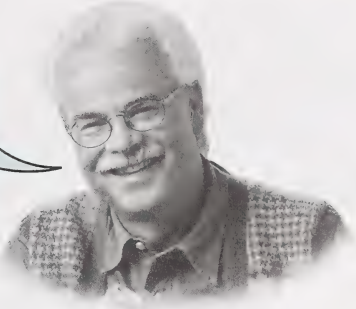
A common feature of distance-time graphs is that the data is continuous and, hence, represented by a line. For a comparison of **discrete data** and **continuous data**, turn to page 21 of the textbook and read the introductory paragraphs of Tutorial 1.2, “Time Graphs.” Compare the graphs presented.

**1.** What type of graph does discrete data produce?

**2.** What is the distinctive feature of a graph of continuous data?

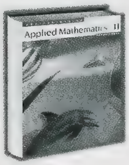
**Compare your responses with the suggested answers in the Appendix, Activity 2, page 50.**





A time graph will have time on one axis—usually the horizontal axis—and one of various other quantities, like distance or temperature, on the vertical axis.

Are all time graphs continous?



Turn to page 22 of the textbook and read the information and study the graph in “Investigation 1: Olympic Records.”

**3.** Answer exercises 1 to 4 of “Investigation 1: Olympic Records” on pages 22 and 23.

**4.** Is it valid to join the points in the graph in Investigation 1? Explain.

**5.** How would you draw a line to describe the trend in the graph in Investigation 1?

**Compare your responses with the suggested answers in the Appendix, Activity 2, page 50.**

The points on a graph of discrete data, such as those in Investigation 1, cannot be joined with a line.

Turn to pages 23 and 24 of the textbook and read "Investigation 2: Wasted Water" carefully so you understand the procedure. In place of the pop bottle, it is recommended that you set a kitchen tap to drip at a rate of about 1 drop per second.

**6.** If you have access to a graduated cylinder and a watch with a second hand, complete the investigation to obtain your own data and answer exercises 3 to 8 of "Investigation 2: Wasted Water" on pages 23 and 24 of the textbook. If you do not have access to a graduated cylinder and a watch with a second hand, use the following data to answer exercises 4 to 8 of "Investigation 2: Wasted Water" on pages 23 and 24 of the textbook. **Note:** In exercise 8, use your result from exercise 7, not exercise 6.

| Time (min) | Volume (mL) |
|---|---|
| 0.5 | 1.4 |
| 1.0 | 2.8 |
| 1.5 | 3.8 |
| 2.0 | 5.0 |
| 2.5 | 6.2 |
| 3.0 | 7.4 |
| 3.5 | 8.4 |
| 4.0 | 9.4 |
| 4.5 | 10.2 |
| 5.0 | 11.2 |

**7.** Calculate the amount of water that would drip out in 1 year. Give your answer in millilitres and in litres. Is this amount of water significant in terms of quantity and cost?

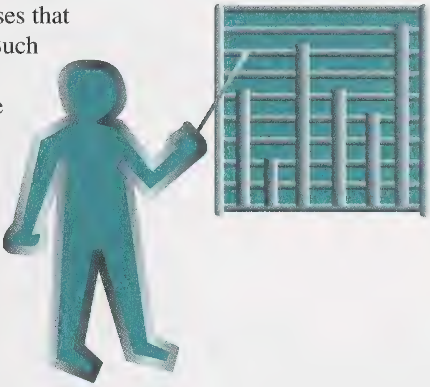
**Compare your responses with the suggested answers in the Appendix, Activity 2, pages 50–51.**

You have seen that data can be entered as discrete points, but the graph of that data may be interpreted as continuous. That is, it is valid to join the points with a line because the points between the data points have meaning.

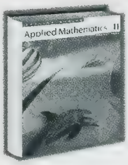
**8.** Turn to page 26 of the textbook and complete exercises 1 and 2 of "Exercises: Checking Your Skills." For exercise 1, explain why you chose discrete or continuous for each situation.

**Compare your responses with the suggested answers in the Appendix, Activity 2, pages 52–53.**

Businesses often graph data of sales and expenses that have been collected at the end of each month. Such data is considered to be discrete, since it is collected only at month-end. The points may be joined to show the trend rather than using a line of best fit; but the points on the line between the plotted points would have no meaning because, again, the data is collected at the end of each month only.



Turn to pages 24 and 25 of the textbook and work through "Example 1: A Profit and Loss Cycle."



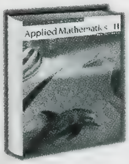
**9.** Answer exercises 4 to 8 of "Exercises: Checking Your Skills" on pages 27 to 29 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 2, pages 53–54.**

Businesses or various agencies can use graphs to analyse a particular situation or problem. View the segment titled *Analysis of Graphs* on the Applied Mathematics 20 CD.

## LOOKING BACK

In this activity you analysed time graphs and identified them as being discrete or continuous. You also created graphs for a variety of situations involving numerical data.



**10.** Turn to page 30 of the textbook and answer "Communicating the Ideas."

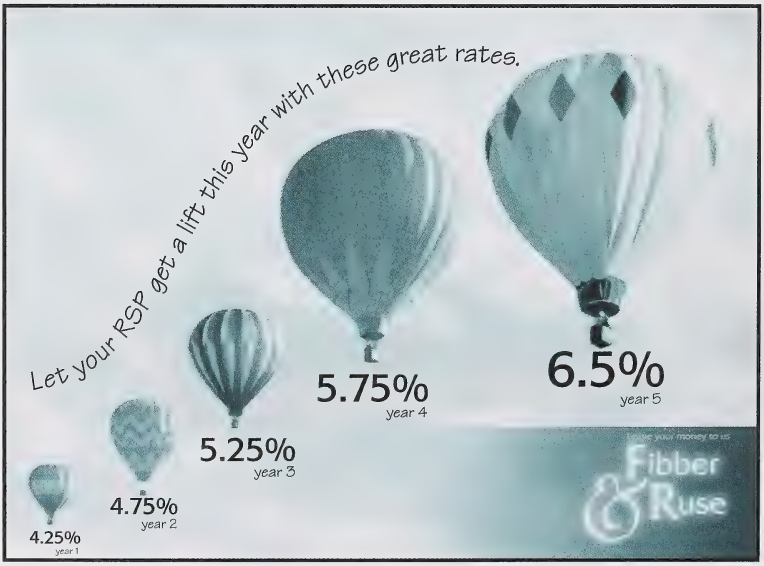
**Compare your response with the suggested answer in the Appendix, Activity 2, page 54.**

# ACTIVITY 3

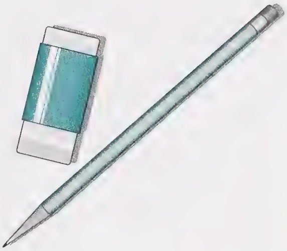
## Misleading Graphs

Companies sometimes use graphs to promote a particular point of view. They may represent the data correctly; however, it may be constructed in such a way as to give a particular impression.

A graph gives a visual representation of data. Usually the representations are fairly simple and direct. Sometimes graphs are designed to promote a particular point of view. Such graphs can often be misleading and lead to different interpretations. The most significant of these is the picture graph.



Turn to page 31 of the textbook and read the introductory paragraphs of Tutorial 1.3, “Misleading Graphs”; then read “Investigation 1: An Advertisement.”



1. Complete exercises 1 to 6 of “Investigation 1: An Advertisement” on page 31 of the textbook.
2. Complete exercises 1, 2, and 4 of “Exercises: Checking Your Skills” on pages 35 and 36 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 3, page 55.**

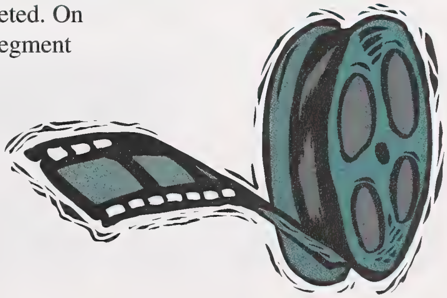
Line graphs can also be distorted to create a particular impression of the data graphed. Using a graphing calculator, you can easily change the view of a graph by adjusting the settings for the *y*-axis.

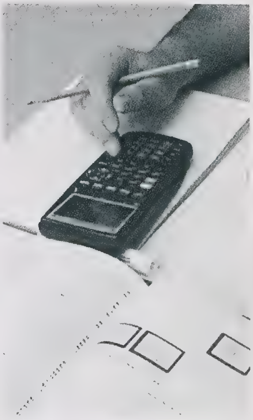
Turn to pages 32 and 33 of the textbook and read “Investigation 2: The Canadian Dollar.”

3. Complete exercises 1 to 5 of “Investigation 2: The Canadian Dollar” on pages 32 and 33 of the textbook.
4. Complete exercise 5 of “Exercises: Checking Your Skills” on page 36 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 3, pages 56–57.**

Sometimes statistical data can be misinterpreted. On the Applied Mathematics 20 CD, view the segment titled *Presenting Statistical Data*.





Histograms can also appear misleading. In particular, changing the scale of a histogram can affect the appearance of the graph. In the next investigation you will use your graphing calculator to explore the effects of changing the scales on a histogram.

Turn to pages 33 and 34 of the textbook and read "Investigation 3: A Class Survey."

5. Complete exercises 1 to 6 of "Investigation 3: A Class Survey" on pages 33 and 34 of the textbook.

6. Complete exercise 3 of "Exercises: Checking Your Skills" on page 35 of the textbook.

7. To summarize what you know about truthful representation of data with different types of graphs, complete exercises 2, 3, and 5 of "Discussing the Ideas" on page 34 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 3, pages 57–58.**

## LOOKING BACK

In this activity you explored different representations of data and evaluated the truthfulness of the presentations.

8. Turn to page 36 of the textbook and answer "Communicating the Ideas."

**Compare your responses with the suggested answers in the Appendix, Activity 3, page 58.**

# ACTIVITY 4

## Graphing Data

A recent traffic accident report shows that driver error is still a major factor in traffic collisions. Other factors in traffic collisions include poor road conditions, mechanical failure, and alcohol. What type of graph would you use to illustrate these factors? Would you draw a bar graph, a line graph, or a stacked bar graph?

In this activity, you will construct graphs from given data, emphasizing the importance of clarity and truthfulness of presentation.

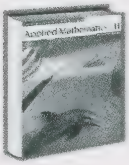
Bar graphs may consist of single bars or multiple bars. Single-bar graphs are used to compare similar data, whereas multiple-bar graphs are used to compare different sets of data. Multiple-bar graphs may consist of stacked bars or single bars arranged side by side.

Turn to page 37 of the textbook and work through "Example 1: Multiple-Bar Graph."

1. Complete exercises 1 and 2 of "Discussing the Ideas" on page 39 of the textbook.
2. Complete exercises 1 and 6 of "Exercises: Checking Your Skills" on pages 40 and 42 of the textbook. **Note:** You may wish to use a spreadsheet program to create your graphs.

**Compare your responses with the suggested answers in the Appendix, Activity 4, pages 58–59.**

Line graphs work well with data gathered over time. Line graphs may appear as single-line graphs or multiple-line graphs.

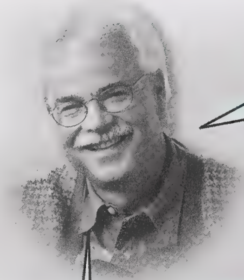


Turn to page 38 of the textbook and work through "Example 2: Line Graphs."

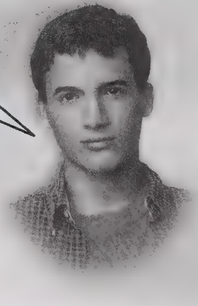
3. Complete exercises 4 and 5 of "Discussing the Ideas" on page 39 of the textbook.

4. Complete exercise 4 of "Exercises: Checking Your Skills" on page 41 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 4, page 60.**



Up to this point, you have only studied graphs with one vertical axis. In some situations, the data may be such that two vertical axes are required. In such situations, it is better to use two different graph types.



You mean, for example, have a bar graph represent one set of data and a line graph represent another? What type of graph is this?

This type of graph is referred to as a **compound graph**.

Turn to pages 38 and 39 of the textbook and work through “Example 3: Graphs with Two Vertical Scales.”

5. Complete exercises 6 and 7 of “Discussing the Ideas” on page 39 of the textbook.

6. Complete exercise 5 of “Exercises: Checking Your Skills” on page 42 of the textbook. **Note:** Complete the graph in this question by hand.

**Compare your responses with the suggested answers in the Appendix, Activity 4, pages 60–61.**

You have looked at several types of graphs in this activity. Now you need to be able to recognize what type of graph needs to be drawn for given data.

7. Turn to pages 40 and 43 of the textbook and complete exercises 3 and 7 of “Exercises: Checking Your Skills.”

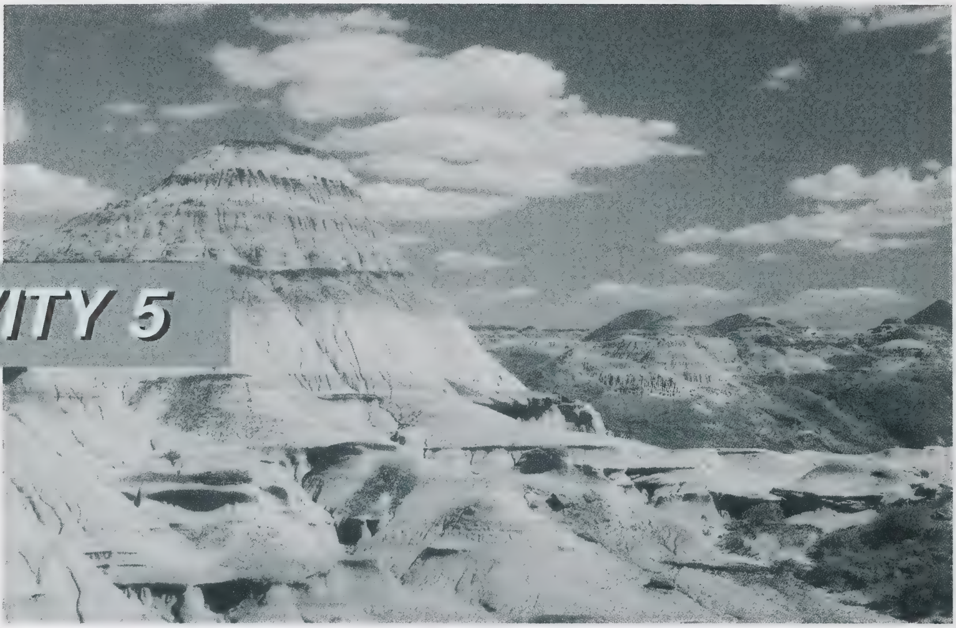
**Compare your responses with the suggested answers in the Appendix, Activity 4, pages 61–62.**

## LOOKING BACK

In this activity you constructed various graphs, including line graphs, bar graphs, and stacked bar graphs. You also constructed graphs with two vertical scales. In the construction of these graphs, you paid particular attention to the clarity and truthfulness of presentation.

8. Turn to page 44 of the textbook and answer “Communicating the Ideas.”

**Compare your response with the suggested answer in the Appendix, Activity 4, pages 63–64.**

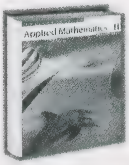


# ACTIVITY 5

## Contour Maps and Weather Maps

Dinosaur Provincial Park, in southern Alberta, holds world-class archeological and geological treasures. These striped hills of ancient sea sediments, although quite plain in their beauty, are photographed by thousands of tourists every year. The alternating layers of different coloured sediments show us how they were built up and how water has worn them down. If you have a chance to hike over hills like these, the different colours help you to tell if you are walking on the level or climbing up or down as you walk along the hillside. Cartographers use a similar method to tell us about the regions that they create maps for. They use contour maps where points of similar height are joined by lines. This is similar to the boundary points of different coloured layers on the hills in the picture.

In this activity you will interpret and analyse contour maps and weather maps. Weather maps are similar to contour maps except, in weather maps, lines join points of similar barometric pressure.



For information on contour maps, contour lines, and weather maps, turn to page 45 of the textbook and read the first two paragraphs of Tutorial 1.5, “Contour and Weather Maps.”

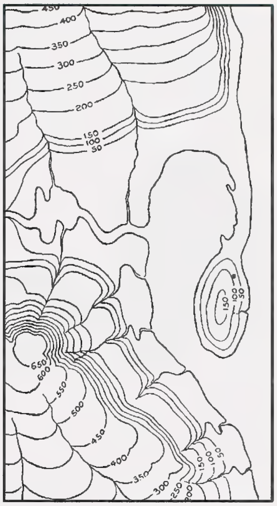
**1.** **a.** What kind of data does a contour map represent?
  **b.** What kind of data does a weather map represent?
  **c.** What is a contour line?
  **d.** How do contour lines indicate the slope of the land?

**Compare your responses with the suggested answers in the Appendix, Activity 5, page 65.**

Turn to pages 45 and 46 of the textbook and read “Investigation 1: Interpreting Contour Maps.”

**2.** Complete exercises 1 to 9 of “Investigation 1: Interpreting Contour Maps” on pages 45 and 46 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 5, page 65.**

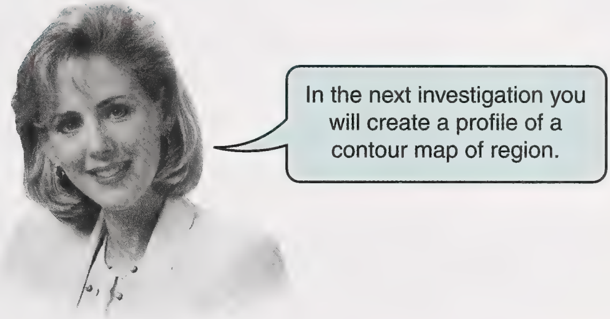


A **contour map** gives you a top view of the topography of a land formation. This is a two-dimensional representation of the height of the land. Sometimes it is useful to view the height of the land formation from the side. This is called a profile of the contour map. You can think of a profile of a hill, for example, as the hill cut vertically in half and with one half removed. You are then looking at the cut side of the hill.

For more information on profiles, turn to page 46 of the textbook and read the paragraph preceding “Investigation 2: Constructing a Profile from a Contour Map.”

**3.** **a.** What is a true profile?
   **b.** What is vertical exaggeration?
   **c.** What is the purpose of using vertical exaggeration?

**Compare your responses with the suggested answers in the Appendix, Activity 5, page 65.**


In the next investigation you will create a profile of a contour map of region.

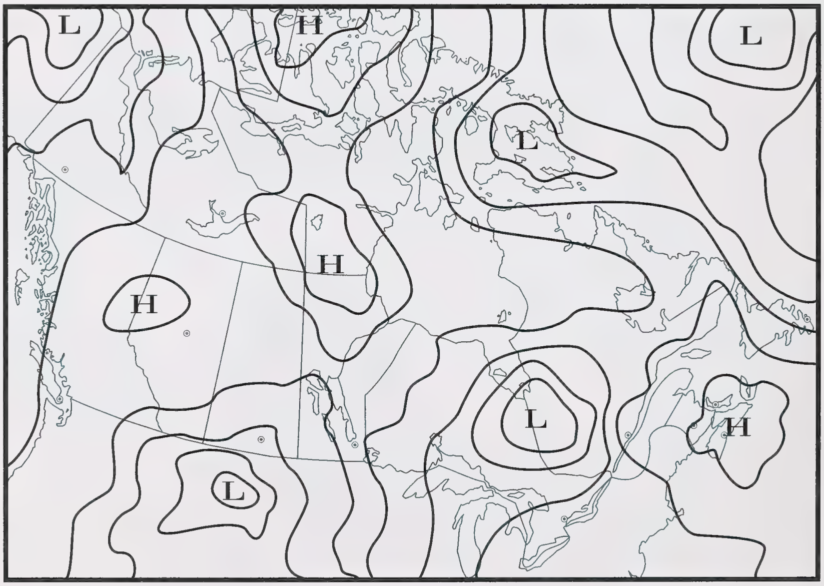
Turn to pages 46 and 47 of the textbook and read “Investigation 2: Constructing a Profile from a Contour Map.”

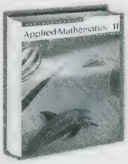
4. Complete exercises 1 to 5 of “Investigation 2: Constructing a Profile from a Contour Map” on pages 46 and 47 of the textbook.
5. How would you describe the profile you created in Investigation 2?
6. Complete exercises 1 to 3 of “Discussing the Ideas” on page 48 of the textbook.
7. Complete exercises 1 and 2 of “Exercises: Checking Your Skills” on pages 49 and 50 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 5, pages 66–67.**

Contour maps can be used to predict locations where a river may flood. On the Applied Mathematics 20 CD, view the segment titled *Interpreting Contour Lines*.

Another map similar to the contour map is a **weather map**. A weather map consists of lines similar to contour lines that represent areas that have the same barometric pressures. You can imagine a weather map as a set of **isobars** that represents the various pressures over the region.





Turn to page 47 of the textbook and read the two paragraphs at the bottom of the page; then work through "Example: Weather Maps" on page 48.

**8.** **a.** What is an isobar?

**b.** How are areas of low pressure and high pressure labelled on a weather map?

**c.** In terms of high pressure areas and low pressure areas, which way does the wind blow?

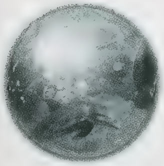
**d.** From which direction do the prevailing winds blow in Canada?

**e.** Why are warm fronts and cold fronts important in weather prediction?

**9.** Complete exercises 4 and 5 of "Discussing the Ideas" on page 49 of the textbook.

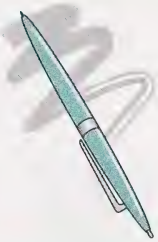
**10.** Complete exercise 5 of "Exercises: Checking Your Skills" on pages 50 and 51 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Activity 5, page 67.**

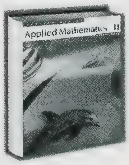


You may wish to use the Internet to search for more information on weather maps and contour maps. Enter the words *weather maps* or *contour maps* into one of the Internet's search engines, and check the links.

## LOOKING BACK



In this activity you worked with two unique ways of presenting data: contour maps and weather maps. You discovered that contour maps convey information about the height above sea level of a land formation and that weather maps convey information about the barometric pressure, temperature, and precipitation of a region.



**11.** Turn to page 51 of the textbook and answer "Communicating the Ideas."

**Compare your response with the suggested answer in the Appendix, Activity 5, page 68.**

# Follow-up Activities

This module dealt with Chapter 1: Graphs in the *Addison-Wesley Applied Mathematics 11 Source Book.*

Turn to page 54 of the textbook and review the important skills and concepts that were developed in this module. Then review the important results and formulas you discovered.

1. Turn to page 55 of the textbook and complete exercise 1 of Part A of "What Should I Be Able To Do?"

2. Turn to pages 56 and 57 of the textbook and complete exercises 4 and 5 of Part B of "What Should I Be Able To Do?"

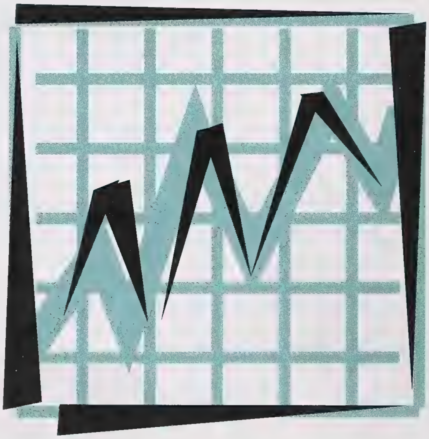
**Compare your responses with the suggested answers in the Appendix, Follow-up Activities, pages 68–70.**

If you had difficulties understanding the skills and concepts in Module 1: Graphs, it is recommended that you do the Extra Help. If you have a clear understanding of the skills and concepts in this module, it is recommended that you do the Enrichment. You may decide to do both.

## EXTRA HELP

In this module you identified and analysed various types of graphs: bar graphs, multiple-bar graphs, and line graphs. Bar graphs are useful when you want a display that is very visual; multiple-bar graphs are useful when comparing two sets of data; and line graphs are useful when predictions from data are required.

To reinforce the ways in which the basic types of graphs are used, turn to pages 55 and 56 and complete exercises 2 and 3 of Part B of "What I Should Be Able To Do?"



**Compare your responses with the suggested answers in the Appendix, Follow-up Activities: Extra Help, pages 70–71.**

## ENRICHMENT

1. Use the Internet to explore the various types of graphs. Enter the name of each type of graph into one of the Internet's search engines and check a number of the resulting links. Write a report in which you describe each type of graph and indicate how it was used in the document.

2. Turn to page 51 of the textbook and complete exercise 7 of "Exercises: Extending Your Thinking."

**Compare your responses with the suggested answers in the Appendix, Follow-up Activities: Enrichment, page 71.**

You may think that the weather is completely unpredictable. However, graphing temperature and precipitation over long periods of time produces surprisingly predictable results. On the Applied Mathematics CD, view the segment titled *Cyclic Patterns*.

# MODULE PROJECT

## EXAMINING DATA

## Completing the Project

By now you should have completed your initial research for your Module 1 project, Examining Data. You should have collected at least two articles or advertisements containing graphs and one containing numerical data.

In this project you will be asked to complete three parts. In Part A you will analyse a graph from an article or advertisement; in Part B you will create a graph from the data supplied in an article or advertisement; and, finally, in Part C you will assess a graph from an article or advertisement that you consider misleading.

Turn to pages 52 and 53 of the textbook and read the information and questions in each of the three parts of "Analyzing Data from Graphs." Make notes on how you would respond to exercises 1, 4, and 9 as you proceed.

**Keep a copy of your notes in the project section of your binder. You will find these notes useful when you complete the questions on Analyzing Data from Graphs.**

Before you continue your module project, turn to pages 58 to 60 of the textbook and read Part C of "What Should I Be Able To Do?" The student here is doing Part B of the Module Project.

1. Answer the two bulleted exercises of Part C of "What Should I Be Able To Do?" at the bottom of page 58 of the textbook.

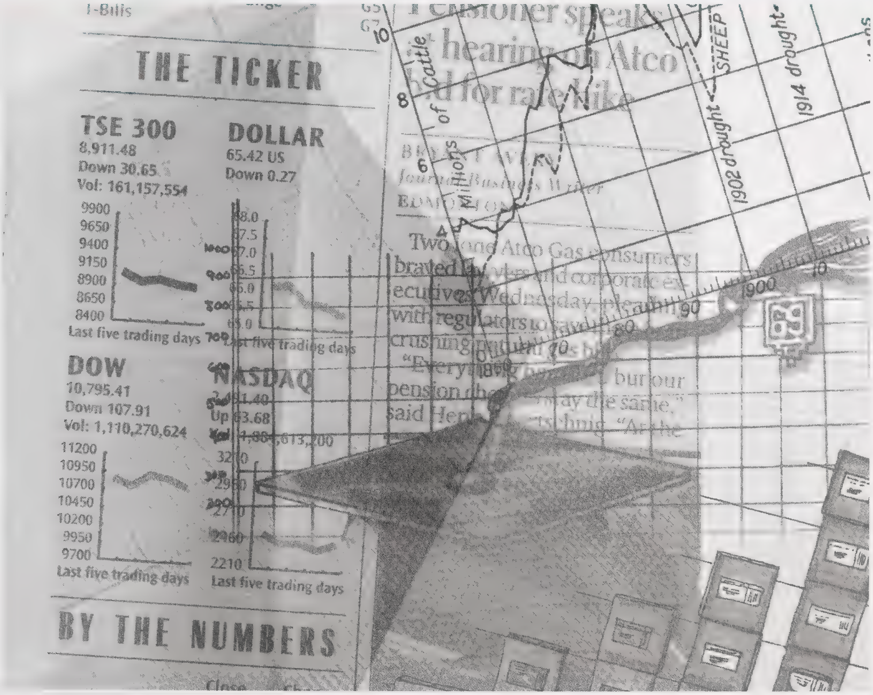
2. Answer the three bulleted exercises of Part C of "What Should I Be Able To Do?" at the bottom of page 60 of the textbook.

**Compare your responses with the suggested answers in the Appendix, Module Project, page 72.**

## Module Project

Now that you have had more insight in the details of "Analyzing Data from Graphs" and you are satisfied with the articles that you have selected for your analysis, you should be ready to complete the project for Module 1. Take out the Project Booklet that accompanies this Student Module Booklet and complete the module project, Examining Data.

**Submit your completed Module 1 Project Booklet to your teacher.**



# Module Summary

In this module you analysed graphs and charts that illustrated various situations. You analysed some basic types of graphs, like bar graphs and line graphs, as well as some unique graphs, like population pyramids, contour maps, and weather maps.

You discovered how to read information from the various types of graphs and to assess the truthfulness of the way the information was displayed. You also created graphs from given sets of data and discovered how to interpret and read information from unique types of graphs, like contour maps and weather maps.

Knowledge of how information is displayed in graphs and tables and how to interpret that information is an important skill in today's world. Often, information is presented in graphs and tables. Satellite communication has given you access to this extensive amount of information through newspapers, magazines, and the Internet.

## Module Assignment

To demonstrate what you have learned in this module, complete the module assignment in the Assignment Booklet.

**Submit your completed Module 1 Assignment Booklet to your teacher.**

# APPENDIX

## Glossary
## Suggested Answers
## Image Credits

## GLOSSARY

**bar graph:** a graph in which numerical data is represented using vertical or horizontal bars

**circle graph:** a graph in which numerical data is represented using appropriate portions of a circle

**continuous data:** data that may assume any value between points, thus allowing the points to be joined with a line

**contour interval:** the distance between two contour lines on a contour map

**contour line:** a line drawn on a contour map indicating the height above sea level of a land formation

**contour map:** a pictorial representation of a land formation using contour lines to indicate the height above sea level

**discrete data:** data for which only the individual points have meaning, thus not allowing the points to be joined with a line

**glyph:** a pictorial representation of words, symbols, or numerical data

**isobars:** lines on a weather map indicating places of equal barometric pressure

**high pressure area:** a region where the isobars indicate an increasing atmospheric pressure toward the center of the region

**line graph:** a graph in which numerical data is represented by one or more line segments

**low pressure area:** a region where the isobars indicate a decreasing atmospheric pressure toward the center of the region

**multiple-bar graph:** a bar graph in which more than one set of numerical data is represented on the same set of axes

**multiple-line graph:** a line graph in which more than one set of numerical data is represented on the same set of axes

**picture graph:** a graph that uses some type of picture to convey the information about the data

**population pyramid:** a graphic representation of the population of a country

**stacked bar graph:** a graph in which numerical data is represented on one set of axes by bars stacked one on the other

**weather map:** a pictorial representation using lines to indicate the changing barometric pressure over a region

## SUGGESTED ANSWERS

### Activity 1: Interpreting Graphs and Tables of Data

**1. Textbook exercises 1 to 4 of "Practise Your Prior Skills," pp. 4 and 5**

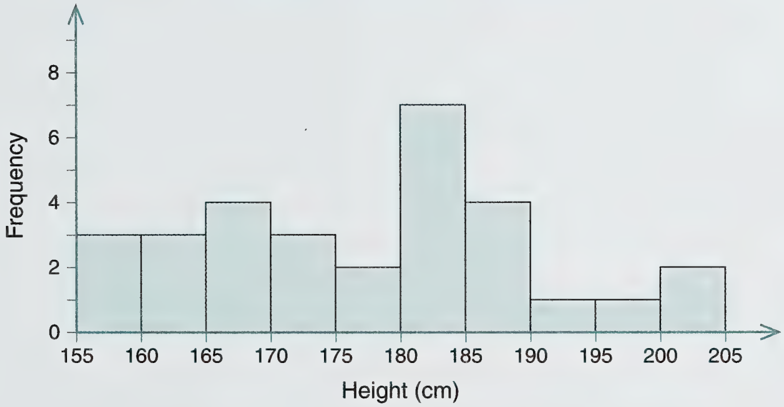
1. **a.** The most frequent range of earnings for this sample is $0 to $10.
   **b.** There were $11+7+1+0+2+0+1+1=23$ students sampled in this survey.

2. a.

| Height (cm) | Tally | Frequency |
|---|---|---|
| 155–159 | /// | 3 |
| 160–164 | /// | 3 |
| 165–169 | //// | 4 |
| 170–174 | /// | 3 |
| 175–179 | // | 2 |
| 180–184 | ~~////~~ // | 7 |
| 185–189 | //// | 4 |
| 190–194 | / | 1 |
| 195–199 | / | 1 |
| 200–204 | // | 2 |

b.

Heights of Grade 11 Students



c. The most frequent range of heights in the class is 180–184 cm.

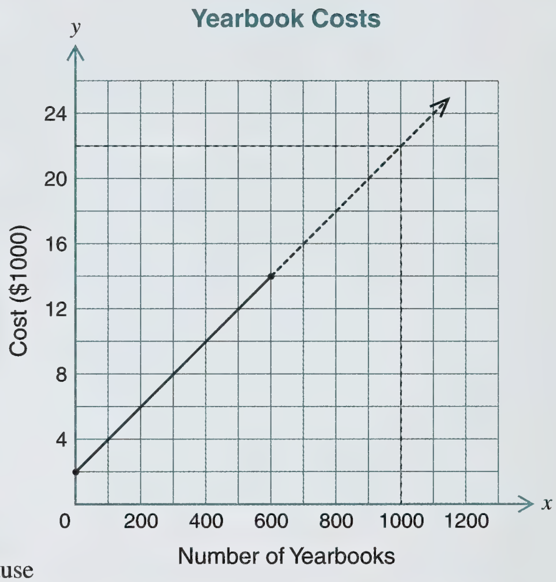
## Activity 1 (continued)

**3.** **a.** The cost of producing 500 yearbooks is $12 000.

**b.**
$$\begin{aligned}\text{Cost per book} &= \frac{\text{Total cost}}{\text{Number of books}}\\ &= \frac{12\ 000}{500}\\ &= 24\end{aligned}$$

When 500 yearbooks are produced, the cost per yearbook is $24.

To determine the cost per yearbook when 1000 yearbooks are produced, you need to find the total cost of producing 1000 yearbooks. If you cannot read the cost of 1000 books from the graph, you can redraw and extend the graph (like the one on the right).



$$\begin{aligned}\text{Cost per book} &= \frac{\text{Total cost}}{\text{Number of books}}\\ &= \frac{22\ 000}{1000}\\ &= 22\end{aligned}$$

When 1000 yearbooks are produced, the cost per yearbook is $22.

The cost per yearbook is not the same because the initial cost of $2000 is the same no matter how many yearbooks are produced. The more yearbooks produced, the less the initial cost adds to the cost of each yearbook.

**c.** According to the graph, 600 yearbooks can be produced for $14 000.

**d.** The cost of producing zero yearbooks is $2000. This cost would cover the expenses of maintaining the print shop. It could include such costs as wages, equipment, building rental, and heating.

**4.** **a.** There are $35 - 7 = 28$ more computers per 100 people in the U.S. than in South Korea.

**b.** Britain and the Netherlands have the same number of computers per 100 people (20).

2. **Textbook exercise 2 of "Exercises: Checking Your Skills," p. 15**

   2. **a.** The population of Canada increases slightly for each of the first three age ranges. The population of Ethiopia decreases substantially for the same age ranges. In Ethiopia the mortality rate is quite high for these three age ranges.

      **b.** No, the number of people in each age range in Ethiopia does not show a bulge at any age range.

      **c.** More people live into the last three age ranges in Canada than in Ethiopia; so, the life span of Canadians is greater than that of Ethiopians.

      **d.** Ethiopia had the greater population in 1998.

3. **a.** A population pyramid is narrower at the top because there are fewer people in each age range near the top.

   **b.** The number of people in the adult ranges (20–24 and up) are considerably less than the numbers in the ranges for children and teens.

   **c.** The population pyramid at the bottom of page 8 of the textbook would be typical of a country like Canada or the U.S., where the mortality rate is low.

4. **Textbook exercises 1 and 3 of "Exercises: Checking Your Skills," pp. 14 to 16**

   1. **a.** There were approximately 4.3 million male births and approximately 4.0 million female births between 1994 and 1998. The ratio of male births to female births is 4.3 to 4.0.

      **b.** There are more males than females in the first seven categories.

      **c.** No, there is no bulge in the population pyramid for Egypt.

      **d.** The bars of the pyramid decrease in length because a significant number of people in each age group die each year.

      **e.** Answers may vary slightly. Estimates from 65 to 70 million are acceptable.

   3. **a.** The male to female ratio for 1961 was about 1300:1260, or about 26:25. The male to female ratio for 1991 was about 775:725, or about 26:24. These ratios are fairly close; so, you can conclude that there was no significant change in the ratio of males to females between 1961 and 1991.

      **b.** The evidence of a baby boom occurs where there is a bulge in population from 25 to 45 in the 1991 graph. The years when the baby boom occurred were from 1946 $(1991-45)$ to 1966 $(1991-25)$.

**c.** There is a narrowing of the 1991 graph at approximately the 52 to 60 age group $(91 - 39 = 52 \text{ and } 91 - 29 = 62)$. There is also a narrowing of the 1961 graph at approximately the 22 to 32 age group $(61 - 39 = 22 \text{ and } 61 - 29 = 32)$.

**d.** There is a narrowing of the 1991 graph at approximately the 46 to 52 age group $(91 - 45 = 46 \text{ and } 91 - 39 = 52)$. There is also a narrowing of the 1961 graph at approximately the 16 to 22 age group $(61 - 45 = 16 \text{ and } 61 - 39 = 22)$. **Note:** Both decreases in the birth rate account for parts of the same narrowing of the graph.

**5. Textbook exercises 4, 5.a, 5.b, and 5.d. of "Exercises: Checking Your Skills," pp. 16 and 17**

**4. a.** The month of August had the greatest total sales.

**b.** September and October had the greatest sales of 3-L cartons of ice cream. The lower portion of the bar is the greatest in each of these two months.

**c.** August had the greatest sales of ice cream cones, slightly edging out July's sales. The difference between the total sales and the sales of 3-L cartons is greatest for the month of August. This difference represents the sales of ice cream cones.

**d.** Sales of 3-L cartons seem to peak in the summer months and then decrease in the winter months.

**e.** The trend in the sales of cones is similar to the trend for 3-L cartons.

**f.** The sales of cones dropped to zero during February and March. Because there is no upper portion to the bar, this indicates that there were no sales of cones in these months.

**5. a.** According to the graph, Canada's population is expected to reach 30 million in 1998.

**b.** The overall population shows a steady increase in population to about 2020; then the population will level off until 2032, when a slight increase in population occurs in each of the last 4 years shown on the graph.

The 0–14 age group shows a fairly steady population from 1992 to about 2025, a slight increase for two or three years, then leveling off again until the end of the graph. The 15–44 age group shows a fairly steady population over the years. The 45–64 age group shows an increase in the first ten years, then leveling off over the remaining portion of the graph. The 65 and over age group shows a substantial increase in population from 1992 to about 2020, then leveling off to the end of the graph.

**d.** According to the trend of the last five years on the graph, Canada's population should reach 40 million in about 2038.

6. **a.** Fixed cost is the normal operating cost of a business. It may include rent, heat, power, insurance, and salaries.

   **b.** Variable cost is the cost of producing merchandise. It varies with the quantity of merchandise produced.

   **c.** Total cost is the combined cost of operating the business and producing the merchandise. Total cost is the sum of the fixed cost and the variable cost.

   **d.** Revenue is the total amount of money received for merchandise sold.

   **e.** Net profit is the difference between the revenue and the total cost.

   **f.** Gross profit is the difference between the revenue and the variable cost.

7. **Textbook exercises 6 and 7 of "Exercises: Checking Your Skills," pp. 17 and 18**

   **6.** **a.** The net profit is the difference between the revenue and the total cost. The revenue when 9500 ties are sold is \$475 000. The total cost of producing 9500 ties is \$362 500.

$$\begin{aligned}\therefore \text{ Net profit} &= \text{Revenue} - \text{Total cost}\\ &= 475\,000 - 362\,500\\ &= 112\,500\end{aligned}$$

   The net profit is \$112 500.

   **b.** The gross profit is the difference between the revenue and the variable cost. The revenue on 9500 ties is \$475 000, and the variable cost is \$237 500.

$$\begin{aligned}\therefore \text{ Gross profit} &= \text{Revenue} - \text{Variable cost}\\ &= 475\,000 - 237\,500\\ &= 237\,500\end{aligned}$$

   The gross profit is \$237 500.

   **c.** The fixed cost is \$125 000.

   **d.** The revenue when 2000 ties are sold is \$100 000. The total cost of producing 2000 ties is \$175 000.

$$\begin{aligned}\therefore \text{ Net loss} &= \text{Revenue} - \text{Total cost}\\ &= 100\,000 - 175\,000\\ &= -75\,000\end{aligned}$$

   The net loss is \$75 000.

## Activity 1 (continued)

7. **a.** Line A represents the revenue, and line B represents the total cost.

   **b.** Oren Promotions must sell 1000 tickets to break even.

   **c.** The revenue when 2000 tickets are sold is \$50 000. The total cost when 2000 tickets are sold is \$30 000.

$$\begin{aligned} \therefore\ \text{Net profit} &= \text{Revenue} - \text{Total cost} \\ &= 50\ 000 - 30\ 000 \\ &= 20\ 000 \end{aligned}$$

   The net profit when 2000 tickets are sold is \$20 000.

   **d.** The revenue when 500 tickets are sold is \$12 500. The total cost when 500 tickets are sold is \$22 500.

$$\begin{aligned} \therefore\ \text{Net loss} &= \text{Revenue} - \text{Total cost} \\ &= 12\ 500 - 22\ 500 \\ &= -10\ 000 \end{aligned}$$

   The net loss if only 500 tickets are sold is \$10 000.

8. **Textbook exercises 1 to 3 of "Discussing the Ideas," p. 13**

   **1.** It is easier to see overall trends by looking at a graph. However, it is easier to obtain exact figures by looking at a table.

   **2.** Based on the figures for 1997 and 1998, there will be about 750 000 vehicles sold in 1999. This prediction is probably within 50 000 vehicles, since the graph is marked every 100 000 vehicles. This prediction is not very precise, but should be fairly reliable (between 700 000 and 800 000).

   **3.** **Advantages**

   - The stacked bar graph gives a visual representation of the total sales as well as the individual sales.
   - Stacked bar graphs use less space across the page.

   **Disadvantages**

   - It is more difficult to determine the quantities for the top part of the stacked bar because it cannot be read directly from the graph.
   - It is difficult to see a trend in the upper bars because they tend not to start at the same level.

9. Sign 1 (stop sign) is a universal road symbol telling the driver that he or she must come to a complete stop when approaching the sign.

   Sign 2 is a road sign telling the driver that he or she is not allowed to make a 180° turn (a U-turn) at that point in the roadway.

   Sign 3 is a sign specifying that no one is allowed to smoke in the designated area to which the sign applies.

10. Sign 1 indicates a vehicle is to stop in the following three ways:

    - The octagonal shape is a universal symbol that means stop.
    - The red colour is a warning of danger.
    - The word STOP is written on the sign.

11. Answers will vary. Some possible occupations in which glyphs are used are as follows:

    - construction
    - publishing (e.g., the icons in this course)
    - flight industry
    - tourist trade
    - chemical industry (labelling)

12. **Advantage:** In most cases, language is not a barrier when understanding glyphs.
    **Disadvantage:** A person could misinterpret a glyph they are not familiar with.

13. **Textbook exercise "Communicating the Ideas," p. 20**

    **Advantages**

    - easy to see trends in graphs
    - information can be interpreted quickly

    **Disadvantages**

    - easier to distort data with a graph either intentionally or unintentionally
    - graphs may take more work and creativity to prepare

## Activity 2: Time Graphs

1. Discrete data produces a graph in which the points are not joined.

2. The distinctive feature of a graph of continuous data is that it is a line graph.

3. **Textbook exercises 1 to 4 of "Investigation 1: Olympic Records," pp. 22 and 23**

    1. The winning distance in 1980 was about 70 m. The winning distance in 1984 was about 65 m.

    2. The Olympics occur every four years. Because the Olympics were in 1980, the next Olympic games did not occur until 1984.

        There were no Olympics in 1940 and 1944 due to World War II.

    3. These data are discrete because the Olympics occur every four years. There are no points on the graph that lie between Olympic years.

    4. The winning distance for women's Olympic discus has increased steadily over the years. You might say that the winning distance for women's Olympic discus has almost doubled since 1928.

4. No, it is not valid to join the points in the graph in Investigation 1 because the Olympics did not occur between the given years.

5. You could draw a line of best fit to show the trend in the graph in Investigation 1.

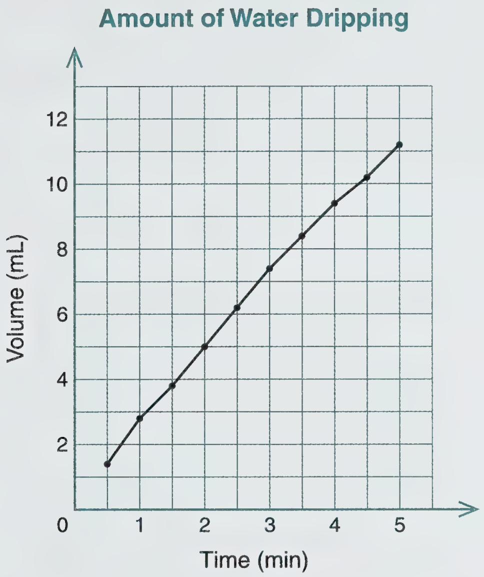
6. **Textbook exercises 3 to 8 of "Investigation 2: Wasted Water," pp. 23 and 24**

    Answers will vary depending on the rate your tap dripped. The following answers are based on the data that was given.

    3.

| Time (min) | Volume (mL) |
|---|---|
| 0.5 | 1.4 |
| 1.0 | 2.8 |
| 1.5 | 3.8 |
| 2.0 | 5.0 |
| 2.5 | 6.2 |
| 3.0 | 7.4 |
| 3.5 | 8.4 |
| 4.0 | 9.4 |
| 4.5 | 10.2 |
| 5.0 | 11.2 |

4. Your graph should be similar to the following. If you are using your graphing calculator, refer to "Utility 18: Determine a Regression Equation for Data Using the TI-83" on pages 411 and 412 of the textbook. This utility provides information on how to determine a regression equation for data using a TI-83 graphing calculator. The data here approximates a linear equation; so, select LinReg in Step 5.b. on page 411 rather than QuadReg.



5. The volume of water collected after 2.25 min is about 5.5 mL. **Note:** If you used your calculator, you may have used the table of values or the Value feature to determine the volume.

6. The data are considered continuous because you are recording the volume of water that has dripped, not the number of drops.

7. The volume of water collected after 10 min is about 22 mL. It is about double the amount that was collected after 5 min.

8. $22 \times 6 \doteq 132$ ← 10 min × 6 = 60 min = 1 h

   The amount of water collected in 1 h is about 132 mL.

   $132 \times 24 \doteq 3168$ ← 1 h × 24 = 24 h = 1 d

   The amount collected in 1 d is about 3168 mL or 3.2 L.

7. $3168 \times 365 \doteq 1\,156\,320$ ← 1 d × 365 = 365 d = 1 year

The amount of water that would drip out in 1 year is about 1 156 320 mL or 1156 L. This amount is quite significant in terms of wasted water as well as cost to the homeowner.

## Activity 2 (continued)

8. **Textbook exercises 1 and 2 of "Exercises: Checking Your Skills," p. 26**

   1. **a.** continuous

      You can have a fraction of a child's weight or age.

      **b.** discrete

      Month-end sales is determined only at the end of the month. Therefore, you cannot have a fraction of the month.

      **c.** discrete

      You cannot have a fraction of a person in the school.

      **d.** discrete

      There is only one winning time for each year.

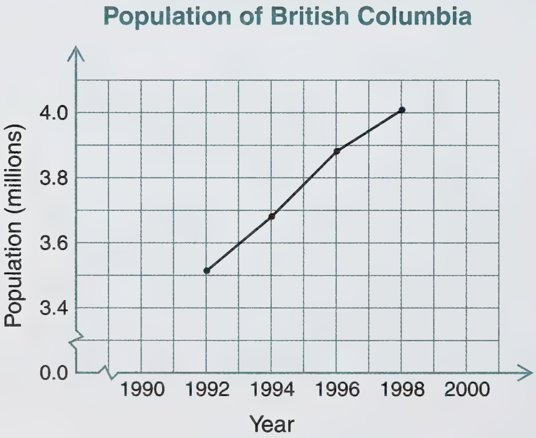
      **e.** continuous

      You can have a fraction of a million of the world population.

      **f.** continuous

      You can have a fraction of the time of day or of the temperature.

   2. **a.**



**b.** The data is continuous because you can have a fraction of the population.

**c.** The population in 1997 was about 3.95 million. This is interpolation, since you are estimating the population between given data points.

**d.** The population in 1999 will be about 4.1 million. This is extrapolation, since you are estimating the population beyond a given data point.

**9. Textbook exercises 4 to 8 of "Exercises: Checking Your Skills," pp. 27 to 29**

**4. a.** The department store made a profit in the months of May to September and in November and December.

**b.** The store experienced a loss in the months of January to April and in October.

**c.** The store can either borrow funds to continue operations or use funds that were saved from previous profits. They also might reduce staff during periods of low sales.

**d.** The business would have more control over costs. This is reflected in the Costs graph being steadier than the Sales graph.

**5. a.** Answers may vary slightly. The lynx population is greater than the hare population from 0 to 6 months, 2 years 3 months to 2 years 7 months, and 4 years 4 months to 4 years 7 months.

**b.** Answers may vary slightly. The populations are the same at 6.5 months, 1 year 6 months to 1 year 9 months, 2 years 3 months, 2 years 7.5 months, 4 years 4 months, and 4 years 7 months.

**c.** Generally, when the hare population drops, the lynx population drops within a few months.

**d.** Generally, when the lynx population drops, the hare population increases within a few months.

**e.** The two graphs are plotted on the same grid to show how one species depends on another.

**6. a.** The data are continuous because there is always fuel in the tank.

**b.** The fuel capacity of this helicopter is 400 pounds.

**c.** The segment from 0 to 1.5 h shows that the helicopter is in operation because there is a continuous use of fuel. The vertical segment at 1.5 h indicates that the helicopter is being refueled. (**Note:** This line is not completely vertical as it takes some time to refuel the helicopter.) The segment from 1.5 h to 2 h indicates that the helicopter is full of fuel but not in operation. The segment from 2 h to about 2.7 h indicates that the helicopter is in operation. The segment from 2.7 h to 3 h indicates that the helicopter is parked once again.

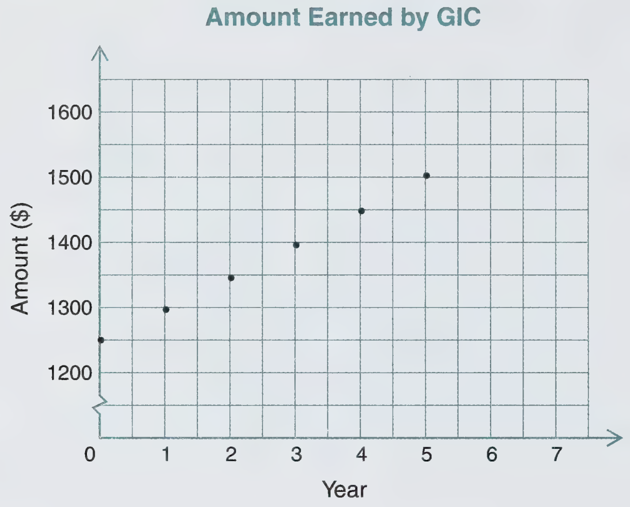
7. **a.** The death rate in 1900 was about 17.3; in 1940 it was about 10.5; and in 1980 it was about 8.5.

   **b.** The trend is that the number of deaths per 1000 in the United States is decreasing. You could illustrate it on the graph with a downward-sloping, curved line.

   **c.** You would have predicted a death rate of about 13 per 1000. This is incorrect because the actual death rate was about 18 per 1000 due to the large number of deaths in World War I.

   **d.** The predicted death rate for 2020 is about 8 deaths per 1000. Possible scenarios could include another large war, an incurable disease, or even an asteroid hitting Earth.

8. **a.**



The points should not be joined because the interest is only added at the end of the year.

   **b.** The amount after 7 years would be about $1615.

**10. Textbook exercise "Communicating the Ideas," p. 30**

Discrete data has points that are individual—the intermediate points have no meaning. Discrete data points should not be joined with a smooth curve, although the points are often joined to indicate a trend. Examples of discrete data include interest amounts paid at the end of each year, winning distances for sports events, and the number of tickets sold versus the total cost for various events.

Continuous data has points that can be joined by a straight line or smooth curve. Intermediate points have meaning and can be estimated using a line or curve joining the data points. Examples of continuous data usually occur on time graphs, like population verus time and fuel consumption versus time.

## Activity 3: Misleading Graphs

1. **Textbook exercises 1 to 6 of "Investigation 1: An Advertisement," p. 31**

    1. The height of the smaller house icon is 2 units, and the height of the larger house icon is 4 units. The width of the smaller house icon is 2 units, and the width of the larger house icon is 4 units.

       The area of the smaller house icon is 4 square units $(2 \times 2)$, and the area of the larger house icon is 16 square units $(4 \times 4)$.

    2. The area of the larger house icon in Graph A is four times the area of the smaller house icon.

    3. The height of all house icons is 2 units, and the width of all house icons is 2 units.

       The area of each house icon is 4 square units $(2 \times 2)$.

    4. The house icons are all the same area.

    5. Graph B fairly represents the data because the graph for 1990 is only twice the size of the graph for 1980, accurately showing that twice the number of houses have been built.

    6. Graph A makes it look like the number of houses built in 1990 is more than twice the number built in 1980. In fact, Graph A makes it look like four times the number of houses were built in 1990.

2. **Textbook exercises 1, 2, and 4 of "Exercises: Checking Your Skills," pp. 35 and 36**

    1. **a.** The profits were $2 million in 1996 and $8 million in 1999.

       **b.** Although, the profits in 1999 were four times the profits in 1996, the graph makes it look like the profits in 1999 were significantly more than four times the profits in 1996.

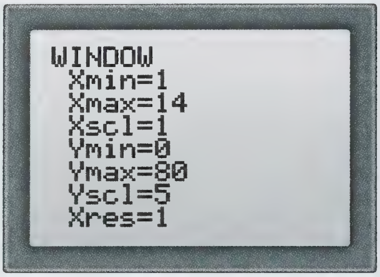
    2. The graph distorts the information because the size of the area for each percentage is not in proper proportion to the actual size of the percentage.

    4. The graph is misleading because the bag with $5 million appears much larger than the bag with $3 million.

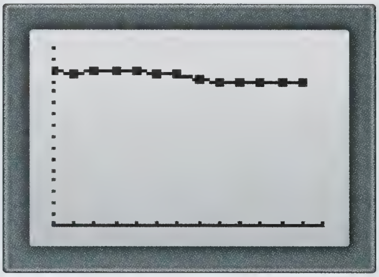
## Activity 3 (continued)

**3. Textbook exercises 1 to 5 of "Investigation 2: The Canadian Dollar," pp. 32 and 33**

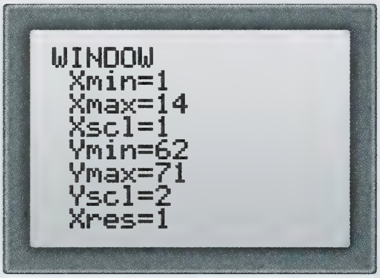
**1. a.**



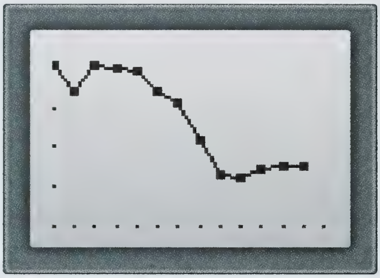
```
WINDOW
 Xmin=1
 Xmax=14
 Xscl=1
 Ymin=0
 Ymax=80
 Yscl=5
 Xres=1
```



**b.**



```
WINDOW
 Xmin=1
 Xmax=14
 Xscl=1
 Ymin=62
 Ymax=71
 Yscl=2
 Xres=1
```



**2.** The graph in exercise 1.a. appeared to change little over time, whereas the graph in exercise 1.b. appeared to change a lot over time.

**3.** Changing the scale on the *y*-axis stretches the graph vertically, thus placing the points further apart. If you change the scale setting on the *y*-axis, you will show a greater change over time.

Graphs will vary. Any pair of graphs like those in exercises 1.a. and 1.b., where one shows little change vertically and the other shows a greater change vertically for the same graph, is correct.

**4.** Units need to be shown on the axes, a title for each axis, and a title for the graph needs to be added.

**5.** The graph in exercise 1.b. will have more impact because it makes the change over time appear larger.

**4. Textbook exercise 5 of "Exercises: Checking Your Skills," p. 36**

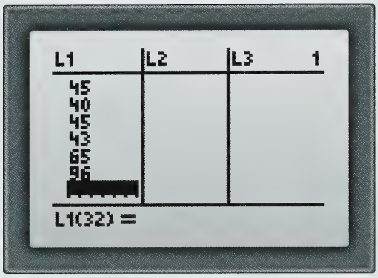
**5. a.** You can get the following information from the graph:

- The maximum salary is greater than the minimum salary.
- Both the minimum and maximum salaries increase from the start of employment until age 30; then the salaries stay constant.
- The minimum salary after age 30 is $32 000 per year.

**b.** The graph implies a relatively large difference between minimum and maximum salaries after age 30. No scale is given; so, the difference between minimum and maximum salaries is left to speculation.

**5. Textbook exercises 1 to 6 of "Investigation 3: A Class Survey," pp. 33 and 34**

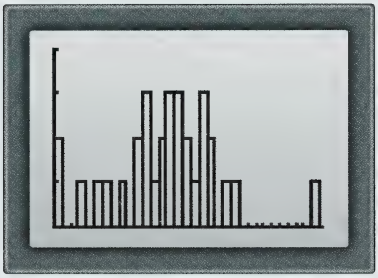
**1.**



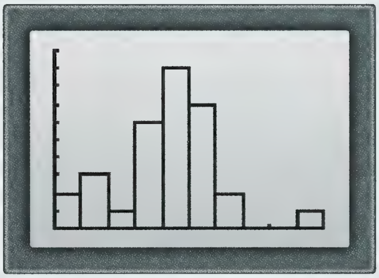
```
L1      |L2     |L3     1
 45
 40
 45
 43
 65
 96

L1(32) =
```

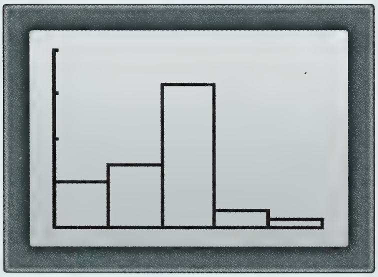
**2.** **a.**



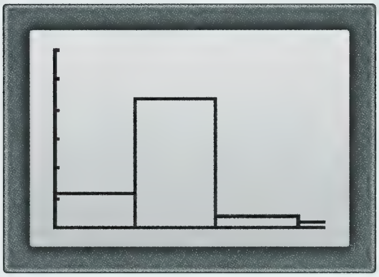
**b.**



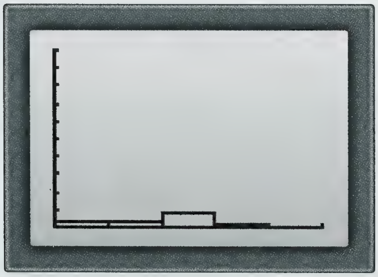
**c.**



**d.**



**e.**



## Activity 3 (continued)

   3. The histogram in 2.e. is the most difficult to read.

   4. The histograms in 2.a. and 2.b. show the spending clearly and truthfully.

   5. It is important to choose a suitable horizontal scale so the graph does not spread out too much.

   6. The vertical scale affects the relative heights of the bars and, thus, the interpretation of the relative values of the bars.

6. **Textbook exercise 3 of "Exercises: Checking Your Skills," p. 35**

   3. The rising arrow that supports the bars gives the illusion that the bars are increasing more rapidly than they actually are. Because the bases of the bars start at different heights, the difference between the figures of 1993 and 1992, for example, appears to be greater than what the actual sizes of the bars indicate.

7. **Textbook exercises 2, 3, and 5 of "Discussing the Ideas," p. 34**

   2. It is important to look carefully at the scales of each axis because the scales affect your interpretation of the graph.

   3. To show the change over the ten years, you would have to choose a large window setting. If you want to show the changes over one week, you would choose a small window setting.

   5. A disadvantage of plotting a histogram with a relatively small horizontal interval for each bar is that each interval will contain few data items, thus making it difficult to determine where the majority of the data lies.

      The disadvantage of plotting a histogram with a relatively large horizontal interval for each bar is that each interval will contain many data items, thus making it difficult to determine the spread in the data.

8. **Textbook exercise "Communicating the Ideas," p. 36**

   Answers will depend on the type of graph you collected and analysed. For example, you may have chosen a picture graph that exaggerated the information by making one part of the graph more prominent than other parts.

## Activity 4: Graphing Data

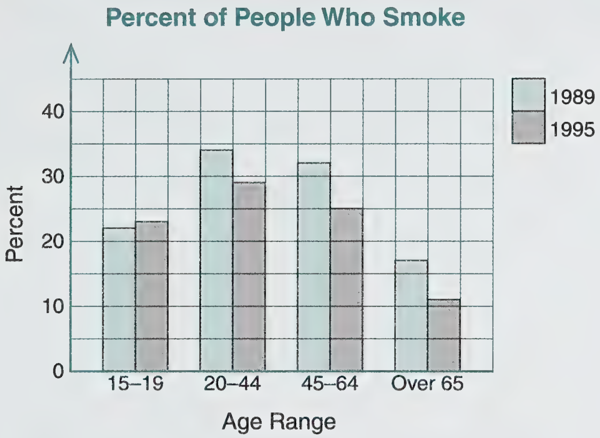
1. **Textbook exercises 1 and 2 of "Discussing the Ideas," p. 39**

   1. A stacked bar graph is suitable for two sets of data that can be added.  In Example 1, the given data involves different information concerning communication, which cannot be added.

2. The actual numbers are not necessary in this graph. It is the relative size of the data that is important, which is shown clearly by the size of the bars.

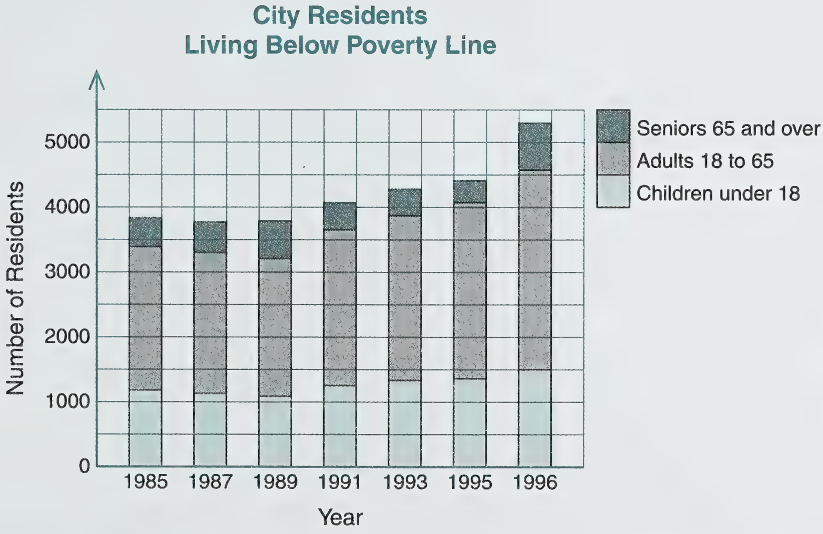
**2. Textbook exercises 1 and 6 of "Exercises: Checking Your Skills," pp. 40 and 42**

**1. a.**



**b.** Compared to 1989, the percent of Canadian smokers in each of the last three age groups decreased in 1995. Also, for both years, the percent of Canadians over 44 who smoke decreased.

**6. a.**



**b.** The total number of residents below the poverty line remained approximately the same from 1985 to 1989, then increased each year to 1996. The number of residents below the poverty line showed the largest increase in 1996. This trend is similar for children under 18 and adults 18 to 65. The number of seniors 65 and over living below the poverty line, on the other hand, increased from 1985 to 1989, then decreased from 1989 to 1995, then more than doubled in 1996.

## Activity 4 (continued)

3. **Textbook exercises 4 and 5 of "Discussing the Ideas," p. 39**

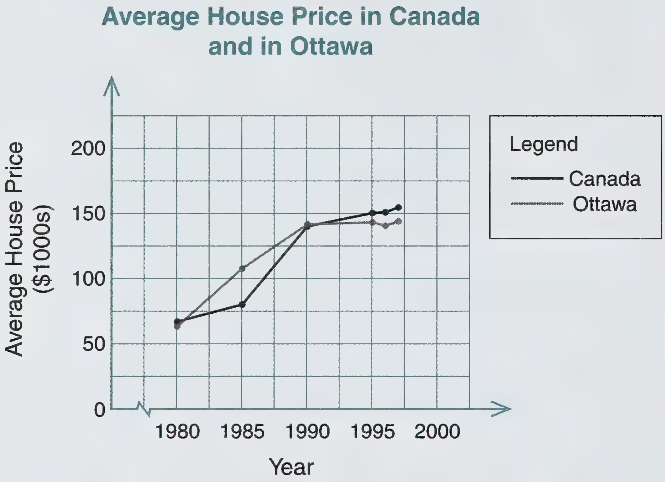
   4. The vertical scale did not start at zero in Example 2 because the data ranged from 89 to 99. If the scale started at zero, the changes in the values in this range would not be very noticeable.

   5. A bar graph is also suitable to display the telephone data in Example 2. To display the data on all three home appliances, a multiple-bar graph or a multiple-line graph could be used.

4. **Textbook exercise 4 of "Exercises: Checking Your Skills," p. 41**

   4. Answers will vary depending on the city you chose.

      a.



      b. The average house price in Ottawa was higher than the average house price in Canada shortly after 1980 to 1990. After 1990 to 1997, however, the average house price in Ottawa was lower than the average house price in Canada.

      c. A booming economy and a significant increase in population in a city or region might lead to a substantial increase in the average house price. A slowdown in the economy and a decrease in population in a city or region might cause house prices to fall.

5. **Textbook exercises 6 and 7 of "Discussing the Ideas," p. 39**

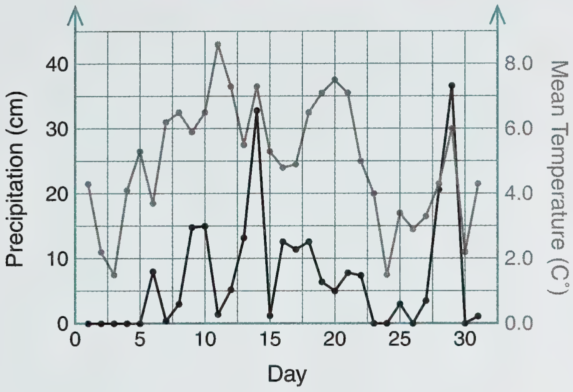
   6. The broken-line graph and the bar graph may have been chosen because there is a minimum amount of interference with one set of data increasing and one set decreasing. If two bar graphs or two line graphs were used, it would be more likely for the reader to confuse the data sets.

   7. Two scales are necessary because the change in the graph would not be very evident for one set of data because it is much smaller than in the other.

6. **Textbook exercise 5 of "Exercises: Checking Your Skills," p. 42**

5.

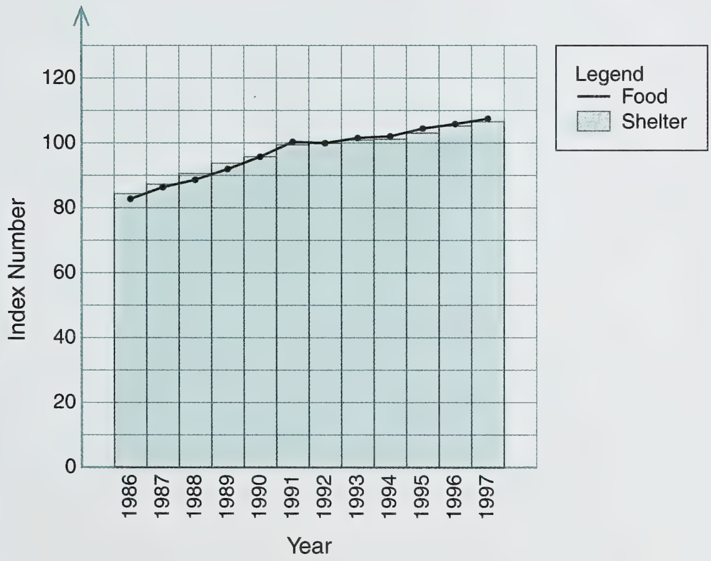
Precipitation and Mean Temperature in Vancouver, January 1999



7. **Textbook exercises 3 and 7 of "Exercises: Checking Your Skills," pp. 40 and 43**

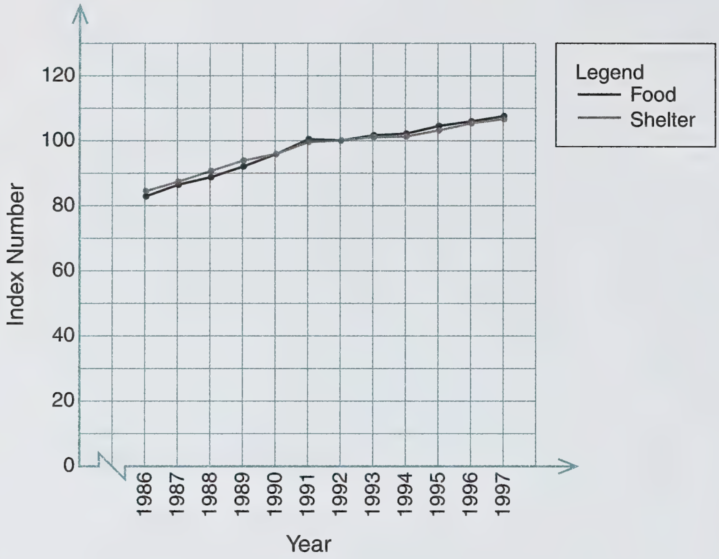
3. You should have used one of two different types of graphs to show the change in the Consumer Price Index for food and for shelter. **Note:** You could have also used a multiple-bar graph; but, in this case, it would have taken too much space across the page.

Consumer Price Index



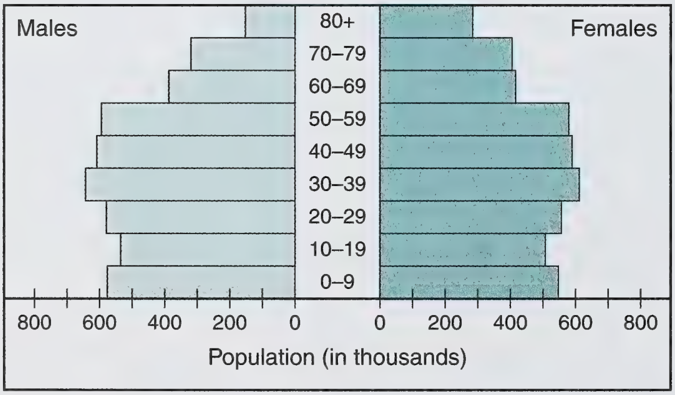
# Activity 4 (continued)

Consumer Price Index

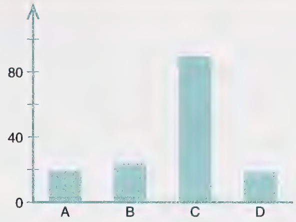
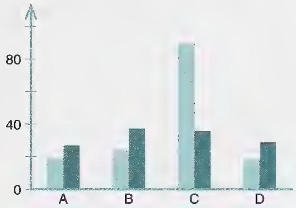
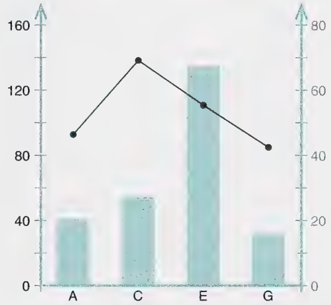
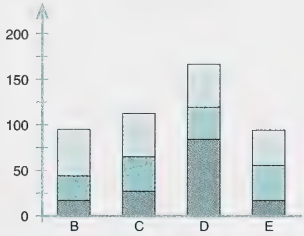


7.

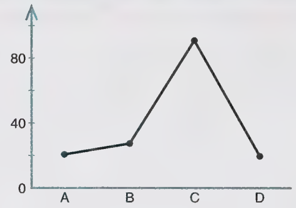
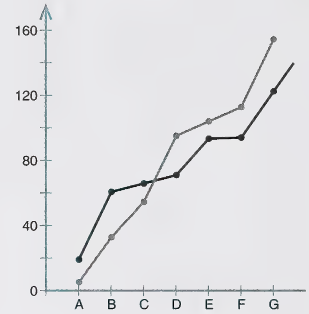
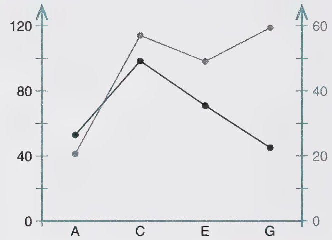
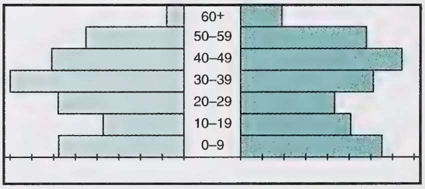
Sweden 1998



**8. Textbook exercise “Communicating the Ideas,” p. 44**

<table>
<tr><th>Graph Type</th><th>Description</th><th>Sketch</th></tr>
<tr><td>Bar Graph</td><td>a graph with single bars to display data</td><td>
</td></tr>
<tr><td>Multiple-Bar Graph</td><td>a graph with multiple bars to display data</td><td>
</td></tr>
<tr><td>Compound Graph</td><td>a graph with more than one set of data and displayed using different graph types</td><td>
</td></tr>
<tr><td>Stacked Bar Graph</td><td>a graph with multiple bars, one set on top of the other</td><td>
</td></tr>
</table>

## Activity 4 (continued)

| | | |
|---|---|---|
| Line Graph | a graph with a line joining individual data points |  |
| Multiple-Line Graph | a graph with more than one line joining different sets of data |  |
| Graph with Two Vertical Scales | a graph with vertical scales on each side, used when different scales are used because data sizes are not compatible |  |
| Population Pyramid | a graph with two horizontal scales, one on each side of a vertical scale, and horizontal bars to represent the data |  |

## Activity 5: Contour Maps and Weather Maps

1. **a.** A contour map represents the heights above sea level of land formations.

   **b.** A weather map represents the varying barometric pressures exerted over a region.

   **c.** A contour line is an outline of a section of a land formation at a particular height.

   **d.** Contour lines indicate the slope of the land formation by how closely they are drawn together. The closer contour lines are drawn together, the steeper the slope of the land formation.

2. **Textbook exercises 1 to 9 of "Investigation 1: Interpreting Contour Maps," pp. 45 and 46**

   1. The contour interval used in the diagram is 100 m.

   2. The height of the land at point A is 400 m. The height of the land at point B is less than 100 m.

   3. The horizontal distance between points A and B on the map is 2.8 cm. Using the scale of $1\ \text{cm} = 200\ \text{m}$, the horizontal distance between points A and B is $2.8 \times 200 = 560\ \text{m}$.

   4. The highest point on this map is over 700 m, assuming the land formation continues to rise. You know that you are within 100 m since there is no contour line beyond 700 m.

   5. No, there is nothing that really indicates which way the river is flowing.

   6. No. The land elevations at the top and bottom of the diagram are the same; so, the riverbed should be fairly flat in the region on the diagram.

   7. The land formation would be that of steep river banks, cliffs, or mountains.

   8. The letter U would best describe this riverbank.

   9. The letter V would best describe each of these valleys.

3. **a.** A true profile is one in which the vertical scale and the horizontal scale are the same.

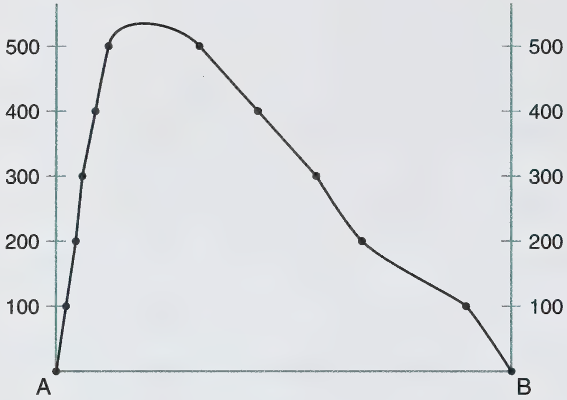
   **b.** Vertical exaggeration is an increase in the vertical scale compared to the horizontal scale.

   **c.** Vertical exaggeration makes the height of the profile greater in relation to the length of the profile than it would be if the two scales were the same. This allows you to have a height with contours that can be easily observed.

# Activity 5 (continued)

4. **Textbook exercises 1 to 5 of “Investigation 2: Constructing a Profile from a Contour Map,” pp. 46 and 47**

**1 to 5.**



5. The profile created in Investigation 2 is a hill with the highest part on one side.

6. **Textbook exercises 1 to 3 of “Discussing the Ideas,” p. 48**

    1. On a contour map, the region where the contour lines are very close together indicates a steep hill or valley. The region where the contour lines are far apart indicates a flat or relatively level area.

    2. You may be able to determine the direction of flow of a river on a contour map by observing the elevation of the area along each side of the river. The river should flow from an area of high elevation to an area of lower elevation.

    3. You will be able to observe the change in either the vertical or horizontal direction more easily if different scales are used. It is important to know these scales in order to have a realistic picture of the region being mapped.

7. **Textbook exercises 1 and 2 of “Exercises: Checking Your Skills,” pp. 49 and 50**

    1.

| Block Model | Contour Map |
|---|---|
| 1 | D |
| 2 | E |
| 3 | B |
| 4 | C |
| 5 | A |

2. **a.** The altitude at point A is about 1300 m.

   **b.** The altitude of the lake is about 600 m.

   **c.** The horizontal distance between B and C is approximately 400 m. **Note:** A horizontal distance of 380 m is also acceptable. The distance can be read accurately to the nearest tenth of a millimetre, either as 2.0 mm or 1.9 mm.

   **d.** Point D is at an elevation of about 1000 m, and the lake is at about 600 m. Therefore, point D is about 400 m higher than the lake.

8. **a.** An isobar is a line that connects places of equal barometric pressure on a weather map.

   **b.** Areas of low pressure are labelled with the letter L, and areas of high pressure are labelled with the letter H.

   **c.** Wind blows from high pressure areas to low pressure areas.

   **d.** In Canada, the prevailing winds blow from the west.

   **e.** Warm fronts and cold fronts are important in weather prediction because the meeting of warm air and cold air often produces storms.

9. **Textbook exercises 4 and 5 of "Discussing the Ideas," p. 49**

   4. Contour maps and weather maps are similar in that they both use lines to indicate areas of equal quantities.

   5. The weather map in the example has solid lines to indicate the areas of equal pressure and dotted lines to indicate areas where equal amounts of precipitation occurred. The solid lines have a label indicating pressure (in hectopascals, hPa). The legend at the top of the map shows that the dashed lines with shaded areas represent areas of equal precipitation. Also, the dashed lines occur in areas of low pressure, which is where precipitation tends to occur.

10. **Textbook exercise 5 of "Exercises: Checking Your Skills," pp. 50 and 51**

    5. **a.** The temperature range for each of the given cities is as follows:

       - Vancouver: 10°C to 20°C
       - Edmonton: 0°C to 10°C
       - Calgary: 10°C to 20°C
       - Winnipeg: 10°C to 20°C
       - Ottawa: 0°C to 10°C
       - New York: 10°C to 20°C
       - Dallas: 30°C to 40°C

       **b.** Rain is predicted in Vancouver.

       **c.** Storms could occur in the area south of Chicago and in the area around Newfoundland.

# Activity 5 (continued)

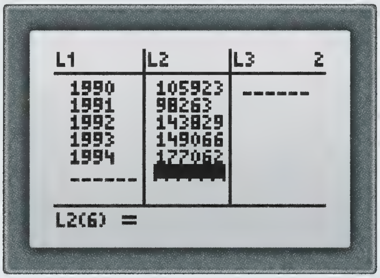
**11. Textbook exercise "Communicating the Ideas," p. 51**

A compass will tell you the direction you are going while a contour map will help you to confirm the location that you are in or approaching. You can use the contour map to pick out the highest or lowest points, and you can use those points to determine where other landmarks may be located.

# Follow-up Activities

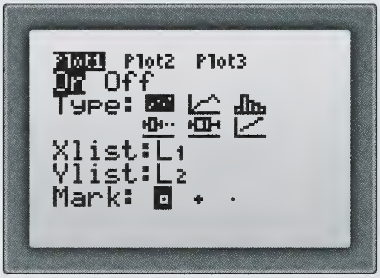
**1. Textbook exercise 1 of Part A of "What Should I Be Able To Do?," p. 55**

**1. a.**



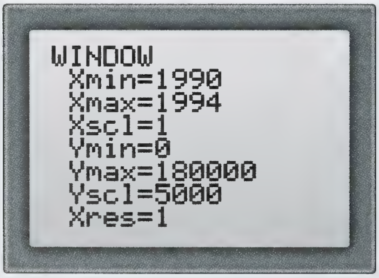
```
L1     |L2     |L3      2
 1990  | 105923| ------
 1991  | 98263 |
 1992  | 143829|
 1993  | 149066|
 1994  | 177062|
 ------|       |
L2(6) =
```

**b.** The data are discrete. Each year is represented by a single sales value. Therefore, an appropriate plot type is the following.

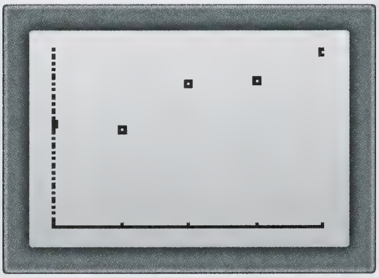


```
Plot1 Plot2 Plot3
On Off
Type:
Xlist:L1
Ylist:L2
Mark: ▫ + ·
```

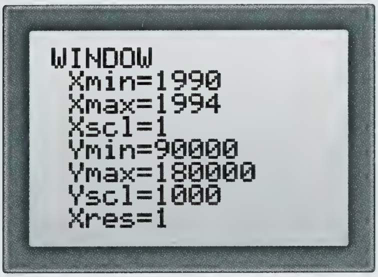
**c. i.**



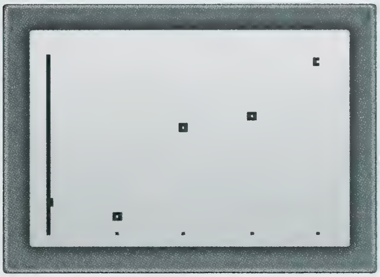
```
WINDOW
 Xmin=1990
 Xmax=1994
 Xscl=1
 Ymin=0
 Ymax=180000
 Yscl=5000
 Xres=1
```



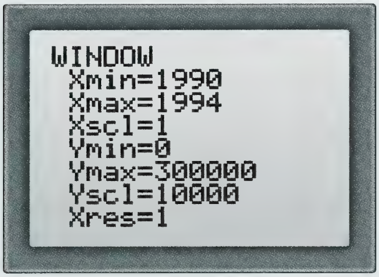
ii.



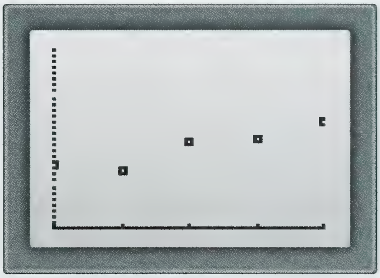
```
WINDOW
 Xmin=1990
 Xmax=1994
 Xscl=1
 Ymin=90000
 Ymax=180000
 Yscl=1000
 Xres=1
```



iii.



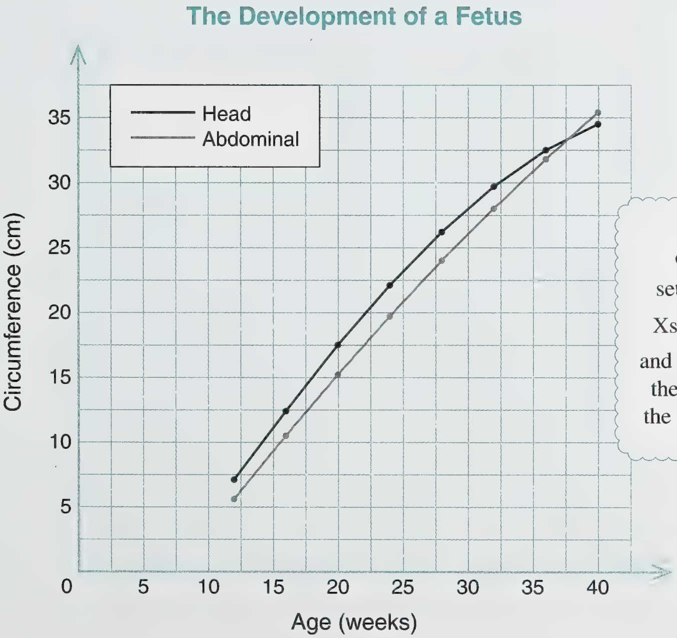
```
WINDOW
 Xmin=1990
 Xmax=1994
 Xscl=1
 Ymin=0
 Ymax=300000
 Yscl=10000
 Xres=1
```



d. The graph using the Y settings in exercise 1.c.ii. represents the increase in sales most truthfully. These settings are closest to the range of Y-values for the five years.

**2. Textbook exercises 4 and 5 of Part B of "What I Should Be Able To Do?," pp. 56 and 57**

**4. a.** Your graphs should look like the following.



If you are using a graphing calculator, use these window settings: Xmin = 4, Xmax = 44, Xscl = 1, Ymin = 4, Ymax = 36, and Yscl = 0.1. Enter the age in L1, the head circumference in L2, and the abdominal circumference in L3.

## Follow-up Activities (continued)

**b.** The data in this exercise are continuous.

**c.** The head circumference at 30 weeks is about 28 cm.

**d.** The abdominal circumference at 25 weeks is about 21 cm.

**e.** The age of a fetus with a head circumference of 25.6 is about 27 or 28 weeks.

**5.** **a.** The western side of the river valley is steepest.

**b.** The altitude at point A is approximately 900 m. The altitude at point B is approximately 400 m.

**c.** The geographic feature at X is a steep cliff on the edge of a ravine. The river flows south.

**d.** The distance from point A to point B as measured on the contour map is about 14.8 cm.

$$\begin{aligned} \therefore \text{ distance} &\doteq 14.8 \times 108 \\ &\doteq 1598.4 \end{aligned}$$

The distance from point A to point B is approximately 1598 m.

## Extra Help

**Textbook exercises 2 and 3 of Part B of "What Should I Be Able To Do?," pp. 55 and 56**

**2.** **a.** The most birthdays occur during the month of October.

**b.** The most males were born during the months of March and October.

**c.** The most females were born during the month of September.

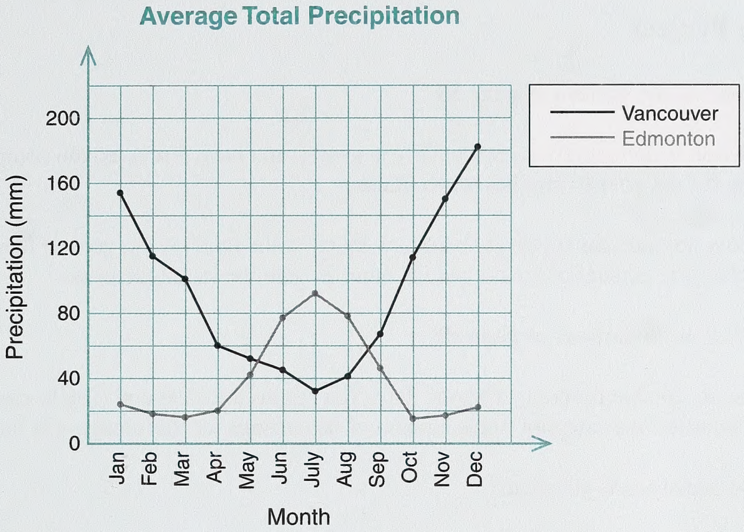
**d.** The same number of males and females were born during the month of October.

**e.** There are 76 females in grade 11 at Ballenas High School.

**f.** There are 96 males in grade 11 at Ballenas High School.

**g.** There are 172 students in grade 11 at Ballenas High school.

3. These data are discrete.



## Enrichment

1. Answers will vary. You should have entered *bar graph*, *stacked bar graph*, *line graph*, *multiple-line graph*, *population pyramid*, *weather map*, *contour map*, or any other graph type into the search engine. You will find various links to documents either about the type of graph or about using the type of graph in a presentation. Research a number of links for each type of graph to gain enough information to complete your description of each type of graph.

2. **Textbook exercise 7 of "Exercises: Extending Your Thinking," p. 51**

   7. Answers will vary depending on the weather map obtained. Sample answers are given based on a weather map for April 8, 2001.

      **a.** The atmospheric pressure in Calgary was between 1008 hPa to 1012 hPa.

      **b.** The lowest pressure predicted (lowest isobar on the map) was 996 hPa on the Ontario-Quebec border near the southern tip of Hudson Bay.

      **c.** The highest pressure predicted (highest isobar on the map) was 1030 hPa in Nunavut just north of Manitoba.

      **d.** The ranges of atmospheric pressures on April 8, 2001, were as follows:

      - Vancouver: 1016 hPa to 1020 hPa
      - Edmonton: 1012 hPa to 1016 hPa
      - Saskatoon: 1016 hPa to 1020 hPa
      - Winnipeg: 1012 hPa to 1016 hPa

      Generally, high pressures result in sunny skies and warm or cold temperatures (depending on the season), while low pressures result in cooler, cloudy/rainy weather.

# Module Project: Examining Data

## Completing the Project

1. **Textbook exercises at the bottom of page 58**

    - The description is not entirely complete. The student could have discussed the comparisons on how much of the tax cut goes to families with children.

    - The data does not indicate anything about how much of the total tax cut goes to families with children. It simply gives the amount of the tax cut for families with the stated incomes.

2. **Textbook exercises at the bottom of page 60**

    - The graphs are suitable for comparing the data. The graphs are clear and easy to read. A comparison of percent of families in a category to the amount of tax savings for that category is fairly easy to make.

    - The student's analysis is adequate.

    - A multiple-bar graph or a multiple-line graph may be a better way to compare percent of families in each category to the amount of taxes cut.

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